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The Welding Engineer

JANUARY, 1944

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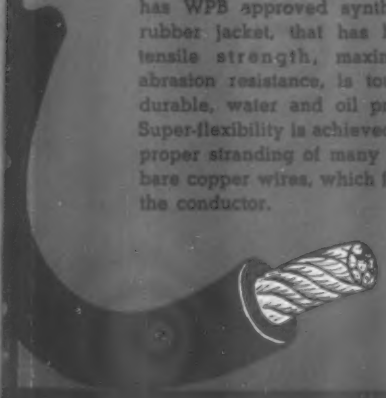

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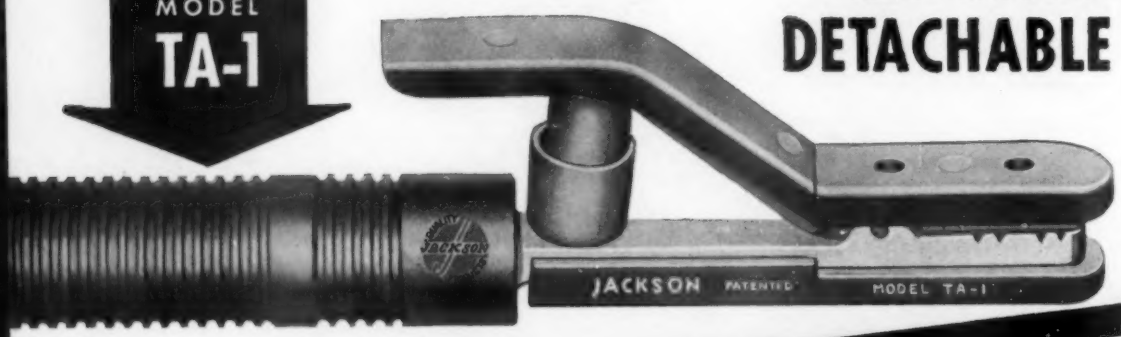
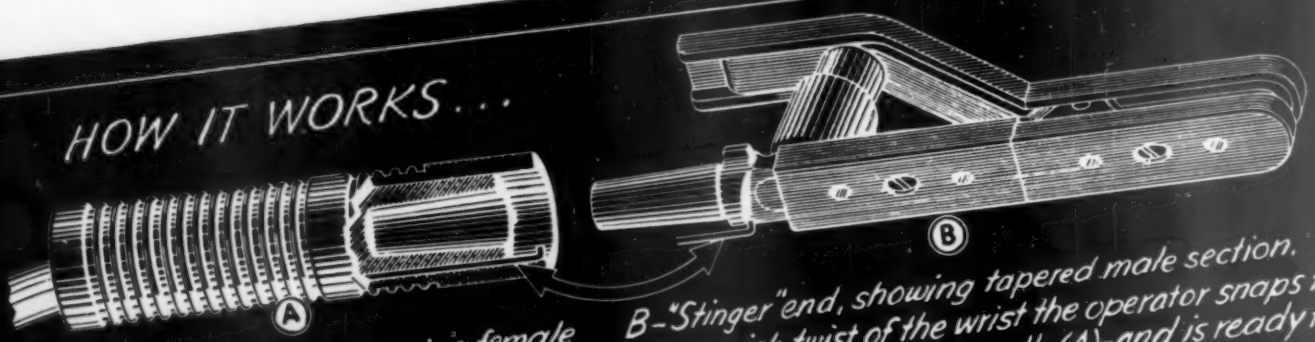
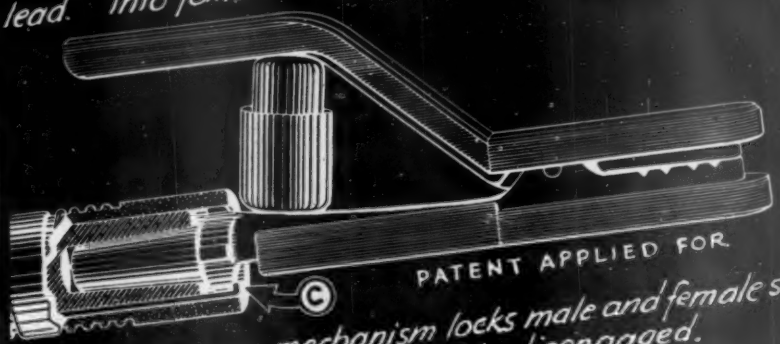


HOW IT WORKS...



A- Insulated handle, containing female section of tapered cable connector which is soldered to cable lead.

B-"Stinger" end, showing tapered male section. With a quick twist of the wrist the operator snaps this into female section in handle (A)-and is ready to go.



C-Actuating cam mechanism locks male and female sections It locks TIGHT- is quickly disengaged.

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Vol. XXIX, No. 1 JANUARY, 1944

IN THIS ISSUE

ARTICLES

1943—A Year of Triumph 35
T. B. JEFFERSON

Short Cuts and Kinks 38

Magnesium Spot Welding 40
W. S. LOOSE

Winning the War on Wear 45
JOHN A. GALLAHER

Warehouse Turns Fabricator 50
J. G. MAGRATH

Editorial 33

On the Job 56

The Technical Slant 66

New Products to Use 68

Engineering Data Sheet No. 40 73

News of the Industry 76

About People 80

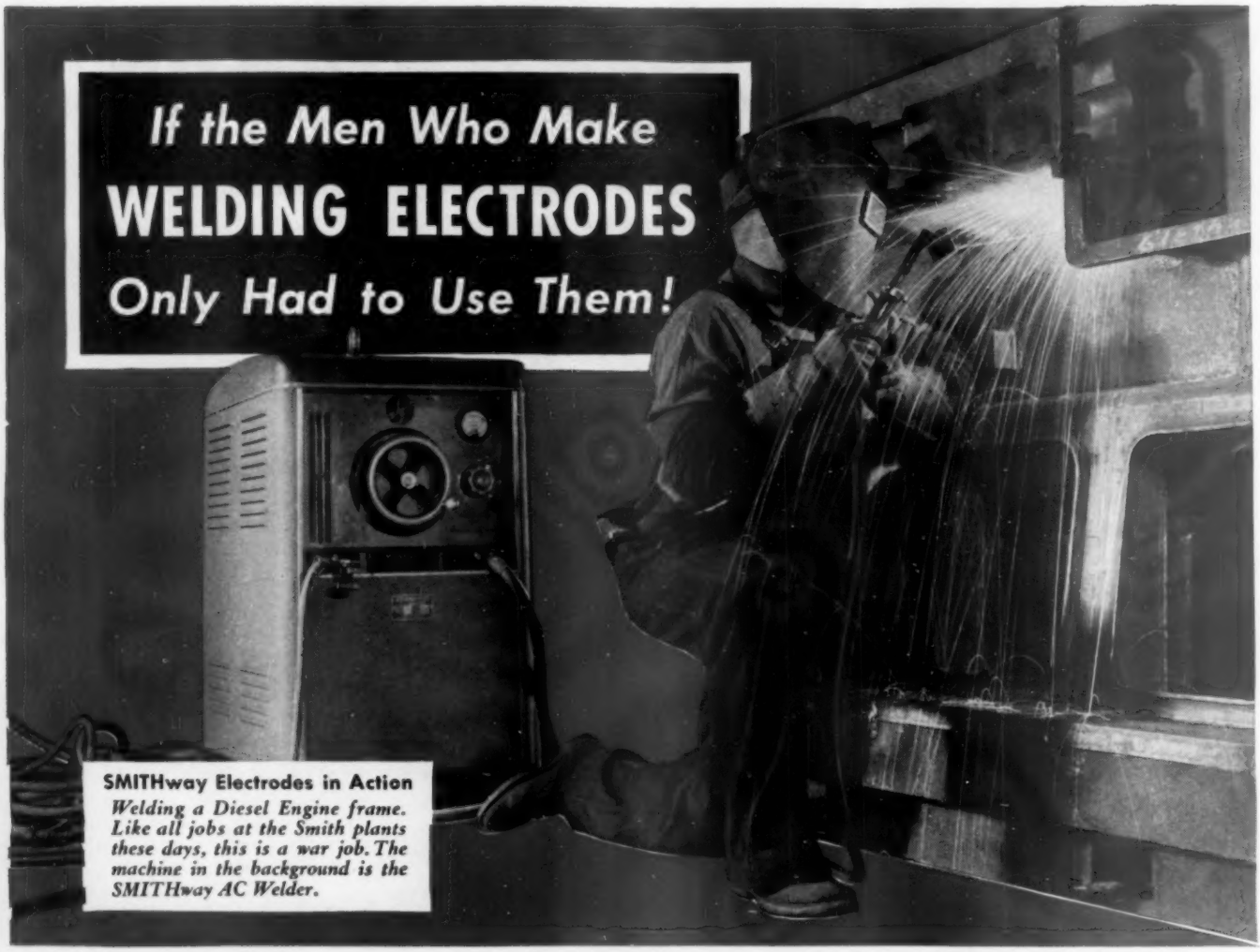
Helpful Literature Just Published 82

Do You Agree? 88

From the Patent Office 88

Classified 96

Advertisers in This Issue 98



SMITHway Electrodes in Action
Welding a Diesel Engine frame. Like all jobs at the Smith plants these days, this is a war job. The machine in the background is the SMITHway AC Welder.

IF the men who make welding electrodes only had to use them—many of your shop problems would cease to be!

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When we tell you that SMITHway Certified Welding electrodes will give you *better welding results* at lower costs, we are stating a *fact* that can be demonstrated in *your* plants.

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

A Brighter Day

The annual coming of the New Year means many different things, according to the interpretations of the different individuals concerned. The New Year to some means new opportunities; to others the time to make new resolutions to do good and be better. To still another group, the New Year is merely a place to pause—to take a breath and reflect for a little while before continuing with the job.

Let the new opportunities of 1944 be for our fighters—soldiers, sailors and marines! Give them the opportunities to overcome and exterminate our ruthless enemies. Give them the weapons, training and leadership to perform that difficult task with the minimum of risk.

Let the resolutions be those of the bureaucrats. Let them resolve to make America a better place in which to live—not by more laws, more so-called "reforms" which only make things worse, but by less bungling and red tape. Let those who now govern us resolve that Americans, too, have the right to the Four Freedoms.

Let the bureaucrats also pause for reflection. Let them remember that many gallant Americans have died and will die so that the rest of the world may obtain that which we have always had and cherished: Freedom of Speech, Freedom of Religion, Freedom from Want and Freedom from Fear. Let them pause and reflect before, in the arrogance of wartime powers, they inflict a Gestapo upon our free America. Let them ponder upon the ancient wisdom in the book of the Chinese sage, Lao Tze: that the best government is the one which least interferes with the lives of its people.

The welding industry is among those entitled to pause in retrospect while the bells usher out the old year, ringing down the curtain on twelve months of unparalleled accomplishment. To our group, 1943 was a year of almost unqualified success—and a proved example of the possibilities inherent in the initiative developed by free enterprise.

To reflect upon past accomplishments is only useful if we can guard against the danger of complacency. We are too young an industry, however, to be content to rest upon our laurels. The coming of 1943 found the demand for welding unprecedented because of the efficiency of welded war implements on the field of battle. Hence the industry was faced with tremendous shortages: of equipment, of electrodes, of welding rods, of oxygen, or acetylene. But all of this we took in our stride. One by one the difficulties were overcome as the year rolled on until shortages had finally been turned into surpluses.

Despite a "critical condition" (phrase beloved by bureaucrats), the welding industry was able to work out its own salvation. We did not need to have our problems solved from a desk in Washington. We did the job ourselves through private initiative and resourcefulness, without Government subsidies and despite bureaucratic bungling and endless miles of red tape.

The welding industry kept faith with our fighting men in 1943, and we are proud. We have a right to be proud, we believe, for the welded weapons we are turning out will help to make possible the dawn of a brighter day.

ARC WELDING HIGH LIGHTS

MUREX ELECTRODES were among the first of the "hot rods" available to the welding industry. Introduced thirteen years ago by Metal & Thermit, these heavy, all-mineral coated electrodes for downhand welding were sensational because of the high currents at which they operated and the excellent, X-ray clean weld metal they produced.

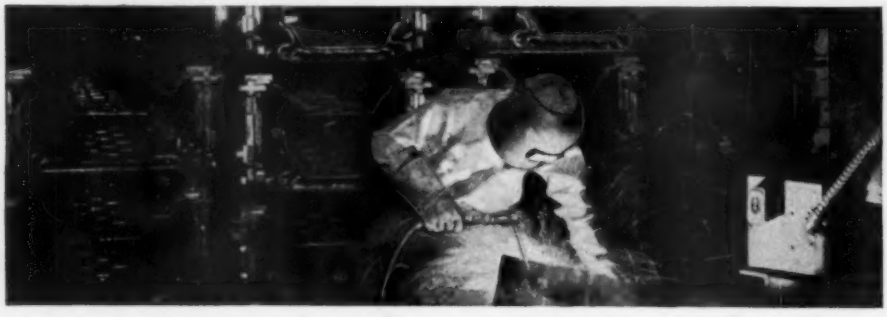
Fabricators of pressure vessels, machine frames, bases and other heavy units were quick to appreciate the advantages of electrodes of this type, and to put them to use in reducing welding costs and improving the quality of welding.

Today, concerns who were among the original users of downhand Murex Electrodes are the leading producers of war materials and are making use of the high speed welding techniques which these "hot rods" make possible to turn out tanks, gun mounts, bombs and other armaments at an unprecedented rate.

Illustrated are several typical applications—past and present—of this kind of welding.

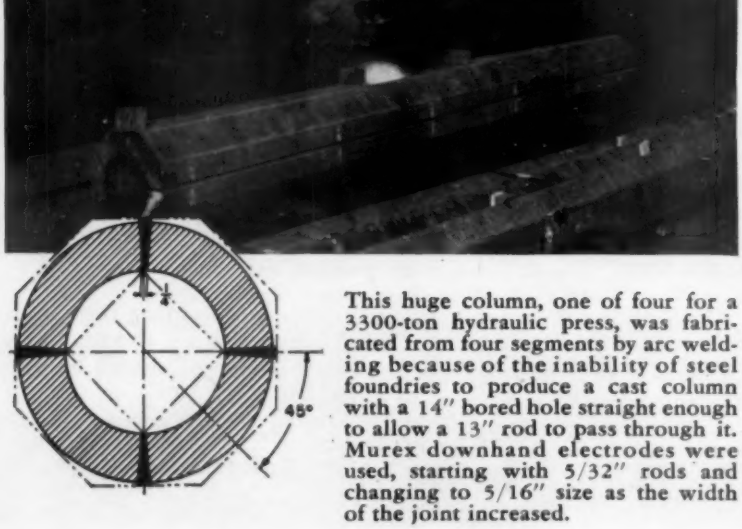
The Murex line, of course, also includes electrodes for all-position work, for use with a.c. equipment, for welding alloy steels and for hard surfacing. Write for the Murex war time catalog.

Pressure vessels, made by Black, Sivalls & Bryson Inc. of Oklahoma City, for low temperature service in the oil refining industry, are fabricated with Murex nickel steel electrodes, chosen because of their fast downhand characteristics and high physical properties. Such pressure vessels are welded as rapidly as mild steel.



In the early days of coal mining every operation was performed by human labor and animal power. Today mechanization dominates every activity. Typical of the heavy equipment, which must stand hard and constant usage, is this Goodman Shaker Conveyor. Photograph shows welding a shovel trough of a duckbill loading head with Murex Electrodes, selected because of the strength and ductility of the deposited metal.

At the plant of the Eljer Co., Salem, Ohio, men who had become skilled in making plumbing fixtures are now turning out 1000-pound bomb casings. Photograph shows arc welding first pass on upper and lower portions of an aerial bomb. The use of downhand Murex Electrodes assures X-ray clean welds of good penetration and excellent ductilities.



This huge column, one of four for a 3300-ton hydraulic press, was fabricated from four segments by arc welding because of the inability of steel foundries to produce a cast column with a 14" bored hole straight enough to allow a 13" rod to pass through it. Murex downhand electrodes were used, starting with 5/32" rods and changing to 5/16" size as the width of the joint increased.

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ARC WELDING ELECTRODES
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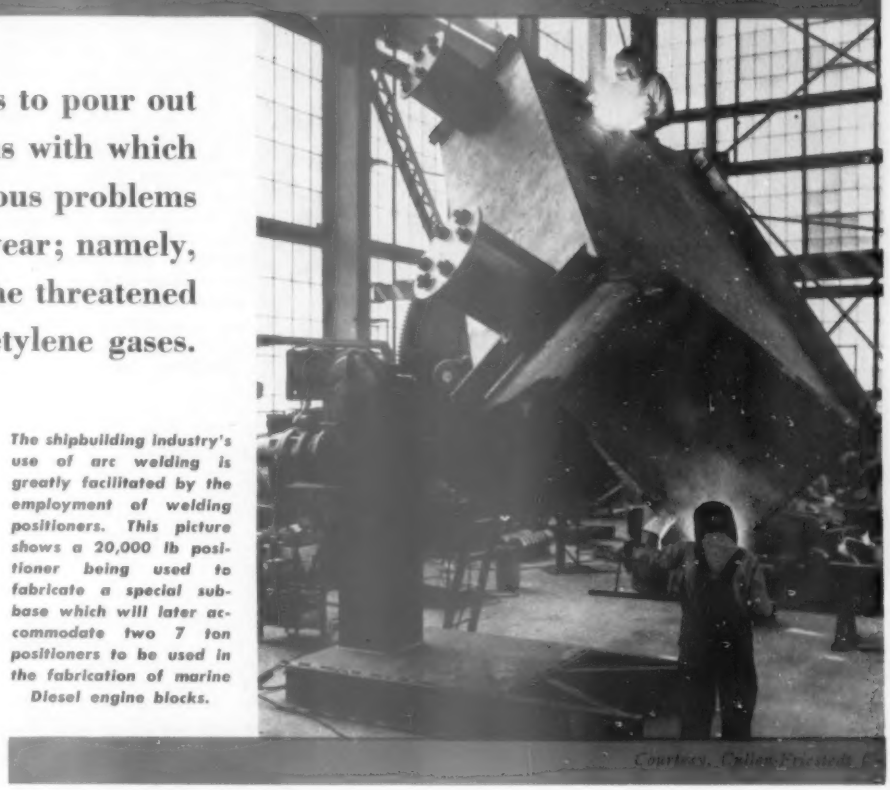
Specialists in welding for nearly forty years. Manufacturers of Murex Electrodes for arc welding, and of Thermit for repair and fabrication of heavy parts.

1943-A YEAR OF TRIUMPH

Welding aids U.S. war plants to pour out planes, tanks, ships and guns with which to smack the Axis. Two serious problems were solved during the past year; namely, the electrode shortage and the threatened shortages in oxygen and acetylene gases.

By **T. B. JEFFERSON**



The shipbuilding industry's use of arc welding is greatly facilitated by the employment of welding positioners. This picture shows a 20,000 lb positioner being used to fabricate a special subbase which will later accommodate two 7 ton positioners to be used in the fabrication of marine Diesel engine blocks.

Courtesy, Collier-Fitzgerald

WHEN historians at some future date undertake to recount the events which took place during World War II, the amazing production capacity of the United States which came into play during the year 1943 will undoubtedly be prominently discussed, for it was in this year that industry released its full productive might—might of such magnitude that even the fondest expectations of our military leaders were surpassed. With the indispensable aid of various welding processes, war plants poured out planes, tanks, ships and guns faster than these implements of war had ever before been produced.

Repair of Ships

Shipbuilders continued as the country's largest users of welding equipment and welding electrodes. The sinking of the S. S. *Schenectady* in January, 1943, led to considerable adverse criticism of welding (even from quarters which should have known better), but subsequent inquiries disclosed that welding, if responsible at all, could share but very little of the blame for this disaster (see THE WELDING ENGINEER, April, 1943, page 42).

On the other hand, welding more than proved its worth during the year as a means of saving ships. Many instances are recorded of welded ships which struck mines or were torpedoed and though severely damaged were able to make port because of the tightness of welded seams. Welding also speeded the return to service of many damaged ships. In combination, flame-cutting and arc welding greatly simplified the repair of those large jagged holes which were the results of enemy mines or successful torpedo hits. In a few instances, welding and cutting provided a means of joining undamaged portions of sister ships so as to form a serviceable craft from an undamaged bow and an undamaged stern of ships otherwise badly damaged.

Prefab Shipbuilding

The subassembly of component parts of ships became much more important in 1943. It was this elaborate system of prefabrication that made it possible for shipbuilders to meet the demands of the Maritime Commission for nearly 19,000,000 dead weight tons of shipping during 1943. Shipyards have been able to subcontract the welding of various assemblies to welding shops throughout the country. In some instances, assemblies have been made hundreds of miles away from the yard which will ultimately use them and shipped by rail. Up to as much as 85% of a ship has thus been completed before the keel was laid. Since this type of construction is merely a matter of assembling the prefabricated parts on the ways, the yards employing such a system can turn out Liberty ships on a production line schedule, holding launchings on certain days of each week and delivering finished ships at definite predetermined periods.

Indeed, shipbuilding has now become such an assembly line process through the extended use of welding that some shipyards are able to build 10,500 ton Liberty ships on a schedule which calls for delivery 28 days after the laying of the keel. One yard established a record of building one ship a day throughout the month of October.

Welding will receive even further boosts in the shipbuilding field with the beginning of construction of the new Victory ship, in the last month of 1943. Shipyards which have heretofore riveted the shell plating to the frames are now planning to weld it. Thus the Victory will be an all-welded ship as compared to the Liberty, a ship which was often of partly welded and partly riveted construction.

Military Requirements

Military authorities continued to increase their demands for welded implements of war. The welded military tank, in particular, exhibited many superior qualities on the field of battle. Tank manufacturers were able to produce satisfactory welds in armor plate despite the shortages of critical materials which constantly necessitated changes in electrode composition. Tank production has overflowed even the apparently insatiable maw of the military machine, and production for the coming year has

A portable welding gun secures the back and side panels of jeep bodies at the American Central Mfg. Corp. Through such methods, the company has doubled its daily production rate since early last summer and at last report was close to its 300,000th jeep body.

been set at around 75% of the 1942 average. It should be noted that the 1943 production of combat tanks was only 17% higher than the 1942 output. This increase could have been much greater, and the fact that it was not is due solely to a lessened demand by military authorities.

Weldor Training

The extensive applications of welding led to a continuation of the many weldor training programs in progress throughout the country. The training of weldors was divided among vocational schools and in plant training systems. In the year which ended in September, 1943, a total of 442,000 students had been enrolled in various welding training programs. Some 360,000 of these were studying arc welding, 65,000 gas welding and 16,000 flame-cutting.

More than half of the trainees enrolled in welding training courses in 1943 were studying to become ship weldors. About 32,000 were specializing in aircraft welding while 160,000 were following miscellaneous welding courses. During the year, about 86,000 women enrolled for instruction in welding.

Arc Welding

Arc welding continued in 1943 to be the most extensively used welding process in connection with our war production program. However, the increase in use of arc welding, though quite pronounced, was not so much as in the previous year.

Equipment manufacturers found themselves in a much better position to handle the demand for welding equipment in 1943 than they had been during the previous year. Most of the backlog of orders for welding equipment had been filled by mid-summer. Many producers were then in the happy position of supplying welding equipment from stock to users with sufficiently high priority.

The opening of several West Coast electrode manufacturing plants early in the year greatly relieved the acute electrode situation which had been experienced throughout 1942. The small welding shop was benefited considerably by the relaxation of limitations on the sale of electrodes by the War Production Board. Through the easing of priority requirements the rural job shop was able to obtain sufficient electrodes to aid in the maintenance of farm equipment. This action was not taken until late in the spring season, however, and in some instances farmers suffered.

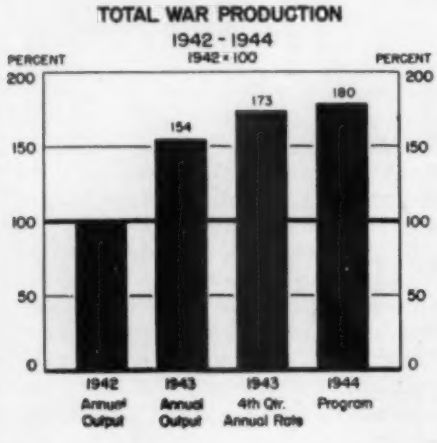
Electrode Production

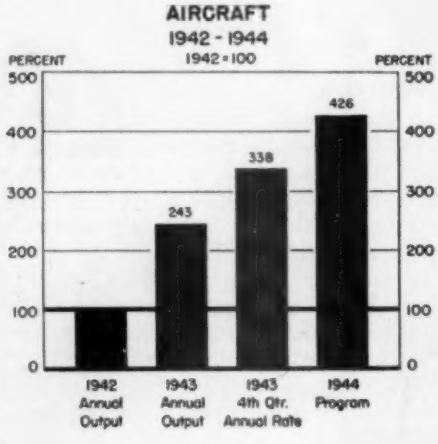
Early in the year production was running around 70,000,000 lb per month, which was materially behind the demand. Electrode manufacturers, however, were able to increase electrode production until now it is well over 100,000,000 lb a month. The total electrode production for 1943 will probably exceed a billion pounds as compared to 740,000,000 lb for 1942.

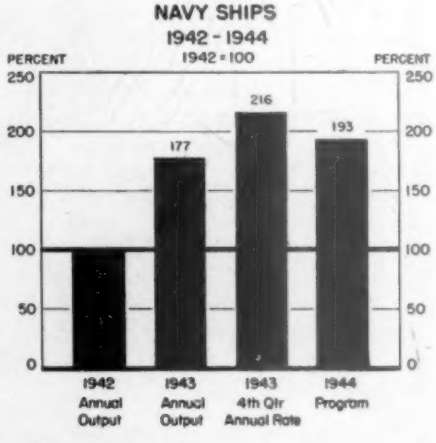
In some instances, shipyards were forced to use bare electrodes for tacking. A case can be built in favor of this practice, however, for it eliminates the necessity of removing slag from the deposited welding metal prior to subsequent weld-metal deposition. Schools also were forced to use bare electrodes as well as many "seconds." Here again, the situation was not too critical, for numerous authorities believe that it is highly desirable to train welding students with bare electrodes.

Positioner Use Increased

The popular acceptance of a-c welding by war industries continued so that much of our war production program is now being carried on by this process. The increased production of satisfactory all-position a-c electrodes as specified by AWS designation E-6011 contributed much to further the use of a-c welding.







Another factor which contributed to the use of a-c welding was the fact that so many manufacturers are using positioners in connection with their welding activities. Larger and larger positioners are now finding their way into our war production industries so that it is not at all unusual for a tank arsenal to position all of the welding on a tank hull or for shipbuilders to position large assemblies of a ship. The efficient use of positioners simplifies the welding operation by permitting most of the welding to be accomplished in a downhand position. This, naturally, makes for greater speed in welding.

Though supplemented by arc and resistance welding, gas welding is still being widely used throughout the aircraft industry for delicate assembly jobs. This operator uses the torch to work upon a boiler for an aircraft heating system.

Courtesy, Detroit Stamping Co.

Gas Welding and Cutting

Gas welding, cutting and the various flame-treating processes experienced a continued increased demand during 1943, the major demand being that for flame-cutting and flame-treating processes.

There was a shortage of oxygen and carbide in the early part of the year, but the installation of new production facilities and the widespread cooperation throughout the industry on the part of manufacturers of welding gases made it possible to avoid a serious situation in these critical materials. The manner in which this particular picture was so rapidly changed well exhibits the ability of a large industry to cooperate for the mutual benefit of all. Now it appears that there is clear sailing ahead for oxygen and acetylene.

Flame-cutting has become an indispensable part of industrial production. The year 1943 saw an increased tendency towards its use, particularly in the shaping of thick slabs of steel and armor plate. Owing to continued increased demand in the steel industries for greater production, flame-cutting began to play an important role as a means of topping ingots, tapping blast furnaces and similar applications. Flame-cutting is also replacing many heretofore standard shearing operations in steel mills.

Flame-cleaning, -priming, -scaling and -shrinking contributed much towards keeping our shipyards operating at full capacity. The ingenious use of the oxy-acetylene flame as a means of shrinking steel has made it possible to produce deck houses with comparatively straight walls. A technique for shrinking galvanized plates without damage to the galvanized coating was also developed during the year.

Resistance Welding

Resistance welding made new gains in the aircraft industry. In the building of large bombers, however, there still remain many places where rivets might be replaced by spot welds. The major difficulty in making this changeover rests not so much with aircraft manufacturers as it does with Governmental inspection agencies. These agencies are becoming more liberal minded, however, as is evidenced by the 1943 trend.

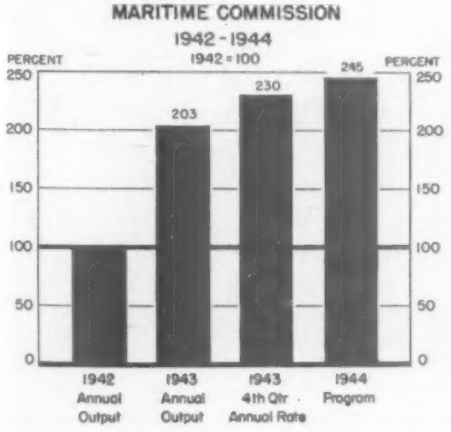
Much progress was made during 1943 in the development of a successful means of flash welding the nickel and high nickel alloy materials used in aircraft construction. These developments in flash welding lead to increased production of the component parts of airplanes. Stored energy weldors coupled with synchronous controlled timers, voltage compensators, weld recorders and sequence timers contributed much to airplane production.

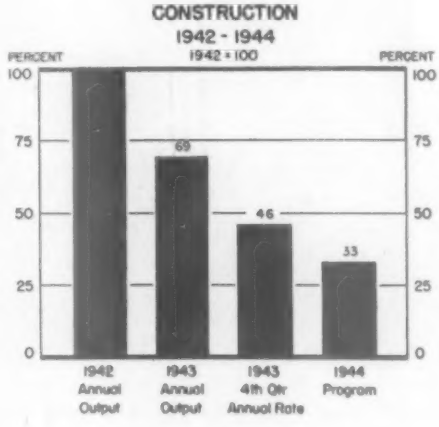
Thermit Welding

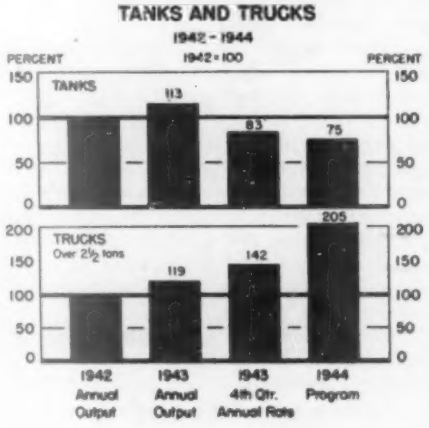
Thermit welding played an important part in making possible the amazing shipbuilding record that was established in 1943. We have already discussed the assembly of prefabricated sections. Through the judicious use of thermit welding, stern frames and other large pieces of cast steel could be united to produce a homogeneous steel frame. This made it possible to bring the capacity of many small foundries to aid in the production of steel frames.

Despite its invasion into the production field, thermit welding has lost none of its importance as a maintenance tool. Railroads, steel mills and many other heavy industries have found it an indispensable tool for maintaining and repairing equipment which today cannot be replaced.

To sum up, the welding industry has through superhuman efforts overcome the several serious handicaps which existed at the beginning of the year just passed. Undoubtedly the industry's efforts (which have played such an important part in our amazing production record of 1943) will be a substantial contribution to our ultimate victory in World War II.







• • • Short Cuts and Kinks

The Exchange of Ideas Leads to Progress . . .

Though the exchange of ideas among workers and managements is valuable in peacetime, it is invaluable in time of war, for such an exchange may help materially to shorten the conflict. Hence the appearance of "Short Cuts and Kinks," a new department of THE WELDING ENGINEER. On these pages, the editors hope to pass on to you ideas which will: (1) save time and money and (2) help to make difficult jobs easier and hard work more pleasant.

This is the one place where you may "get more than you put in," for all the ideas given here are yours without contributing anything in return. Don't be that kind of fellow, though! If you have a welding idea to pass on, then get the kick of seeing your name in print, help others to win the war and help us to keep this feature alive. Send anything you think suitable to Short Cuts and Kinks, THE WELDING ENGINEER, 506 South Wabash Ave., Chicago 5.—*The Editors.*

Increased Cutting Output

A SHOP-BUILT device for multiplying the productive output of a portable flame-cutting machine has been put to use in a New England shipyard. This device makes it possible for a machine to do the work normally produced by two or more machines. It is an attachment which consists of a 10 ft bar balanced crosswise on a cutting machine, with the ends supported cantilever fashion by turnbuckled rods welded at the apex to a plate section (see picture). This bar carries four torches in adjustable positions for trimming parallel edges simultaneously on two plates, one on each side of the machine tracks.

Not only is linear cutting quadrupled by this device, but plate edges are cut accurately parallel. The secondary benefit obtained from this is, of course, a more precise fit-up in assembly, with consequent speed-up of welding on butt joints. Three operators are required to maintain torch adjustment, but on regular production work the machine has produced 1,240 linear ft of cutting in eight hours. The average for a single machine at these yards is 300 ft per eight-hour shift.

The 40 ft track is laid in the trough of several sections of structural channel welded end-to-end, providing protection while plate is being laid out. Cumbersome lengths of gas hose are eliminated by the use of gas pipes mounted parallel to the torch bar. Four round mounting pads are welded at intervals on each side of the bar so that the torches can be fixed in any position along the bar; finer adjustments are made possible by the rack and handscrew supporting each torch.

While this device is of limited application as compared to the large shape-cutting machines whose territory it trespasses upon, it is a very serviceable substitute in shops where these larger machines are overburdened with work which only they can do.

» «

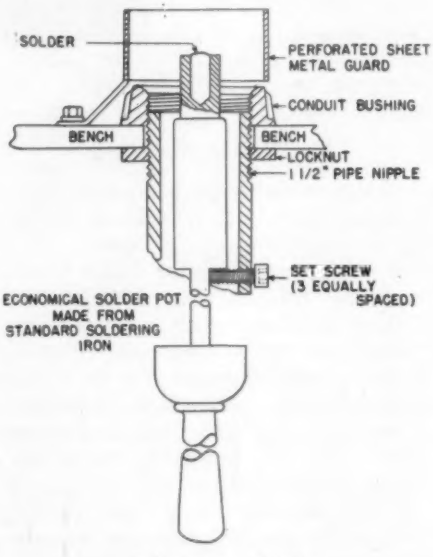
Soldering Pot, Iron

By *R. H. BAINBRIDGE*

THE USE of standard soldering irons especially adapted to small soldering pots has facilitated the production of small instrument-type motors in one of General Electric's plants. Because they present only a very small area for oxidation, the irons are saving materials.

The improvised solder pot is easily built. A standard medium-size soldering iron tip is faced off flat and drilled with a ¼ in. hole, ¾ in. deep. This tip is reassembled to the soldering iron. The iron is then mounted vertically in a hole in the bench so that the tip projects about two inches above the top. The mounting is made permanent by the use of a standard pipe nipple, locked from the top with an electrician's conduit bushing and from the bottom with an electrician's lock nut. The iron is held in the bushing by three setscrews which clamp the body of the iron proper.

Only the insulation contained in the iron itself is required for efficient operation. A perforated sheet-metal guard which encircles the exposed tip permits free circulation of air about the tip, eliminating the possibility of overheating the solder and at the same time assuring complete operational safety by guarding against accidental contact with the heated tip.



Soldering pot details.

» «

Vacuum Clamp

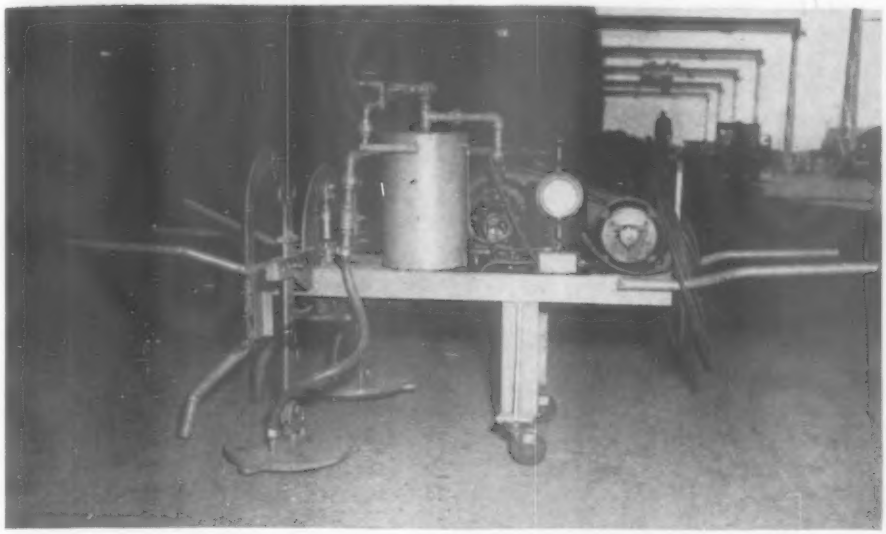
By *WILSON CAMPBELL*

PRIOR to the development of a vacuum clamp using vacuum cups to grip steel plates and pull them against beams for tack welding, a common practice was to use large U-shaped clamps. These clamps were welded to the plate to straddle I-beam stiffeners so that a jack could be used to push down on the beam and up on the saddle. This clamp served its function of holding the beam tight to the plate for tack welding. After tacking, however, there was the problem of removing the holddown saddle, which could be done only by chipping out the weld between the saddle and the plate.

To overcome this difficulty, the machine shown in the illustration on page 39 was built. Made primarily of scrap, it consists of a vacuum pump and two suction "feet."

Courtesy, Air Reduction Sales Co.

Multi-torch contrivance for plate squaring, powered by a standard portable flame-cutting machine.



A vacuum saddle was one of the time-saving ideas presented to the Labor-Management Committee of the Oregon Shipbuilding Corp.

The entire unit can readily be carried by two men. Handle bars on each end make it possible for two men to balance the unit on rollers and move it along the beam.

The two vacuum cups (which eliminate tack welding) are laid on the steel plate and the electric motor driving the pump is started. About three seconds later, the dial indicates that a vacuum has been created, and a hydraulic jack, hand operated, is employed to force the beam down to the plate. The beam and plate are now in position for tacking. Opening an air valve instantly breaks the vacuum, and the machine may be moved on to the next position.

The use of this vacuum saddle presents many advantages. First, less work is required: two shipfitters and two weldors easily do the work which formerly required four shipfitters and four weldors. The fact that no saddles are welded on to be chipped off later represents a considerable saving. One large transverse ship section, for example, requires 20 I-beam stiffeners, and it is necessary to use 100 saddles or more. Over 300 inches of welding and chipping were eliminated in this one section through the use of vacuum clamps.

» «

Portable Bevel Cutter

By *RAY PARCHER*

THE BEVELING of steel deck plates is usually done with a manual cutting torch, but this is not very satisfactory as the beveling is not even and constant. The method is also slow due to the need for changing positions. To avoid these difficulties, I designed a beveling attachment which was accepted for an award by the Labor-Management Committee at the Oregon Shipbuilding Corp.

This portable bevel cutter is a device designed to cut any given angle on steel plate with a hand flame-cutting torch. This is accomplished by the use of a collar, which is set firmly on the head of the torch and supported by two legs. The collar is fixed to the leg assembly by means of a bolt, which, with a lock washer and winged nut, may be moved in a horizontal slot for adjustment. With the aid of a calibrated dial, the cutting tip may be held at the desired angle. By using one of the supporting legs as a guide on the overlapping plate, the torch and attached device are drawn smoothly along the plate as in the usual cutting procedure.

Greater speed and accuracy are the outstanding features of this bevel cutter. With this device, the operator may cut as much as *four* times the distance covered in cutting by hand without changing position. Since the torch is held at a constant angle, the time required to change position is also greatly reduced. The result in actual operation has been the saving of up to 40% in the cutting time on deck plates.

In cutting shell plate butts, it has decreased the time and oxygen-acetylene consumption one-third since it is now possible to cut the plate at two 30 degree angles instead of the three cuts required by the conventional procedure. The new method also saves time in fairing the plates.

There are other ways in which the bevel cutter gives valuable results. The smoothness and uniformity of the cut facilitates the welding process. It makes the job of cutting these plates less tedious, and, by helping the inexperienced to do a more expert job, eliminates the necessity for leadermen to pick certain men for certain jobs. The device may easily be adjusted for the cutting of bulkheads.

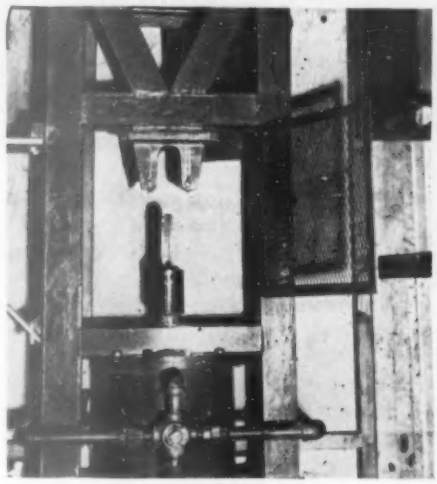
» «

Bend Test Jig

By *JAMES L. REDMOND*

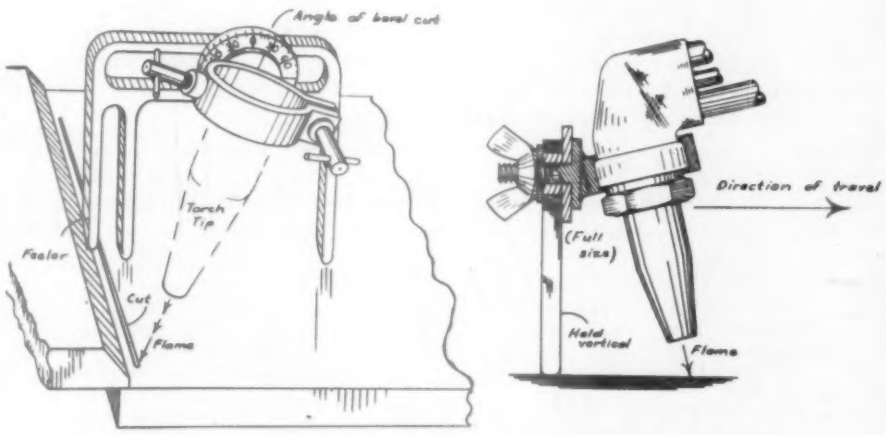
AT MARINSHIP CORP., Sausalito, Calif., it formerly took two men about three minutes to make a weld-bend test coupon. To overcome this difficulty, I recently submitted a suggestion to the War Production Drive which resulted in the weld test bending jig and hydraulic press shown in the accompanying illustration.

The weld-test coupons are bent to 180 degrees. Previously the dies in the bending jig had stretched the steel because of the pressure of bending it through 180 degrees to a 1 ¼ in. radius. To avoid this, we designed a new die which has two 1 in. diam steel rollers located at the top. Now when the coupon is bent, the test specimen rolls along the edge of the die instead of sliding as previously. A water-operated hydraulic press is also used to force the coupon into the die so that now one man can bend two specimens a minute if necessary.



Jig and hydraulic press for bending test coupons.

The cost of building this device was only $45. Its use made it possible to free one man for other work and still increase our production six times.



A portable bevel cutter. Left: construction details; right: best position of torch for cutting.

★ PRODUCTION

Magnesium Spot Welding*

Problems encountered in the spot welding of magnesium alloys are very similar to problems of aluminum alloy spot welding.

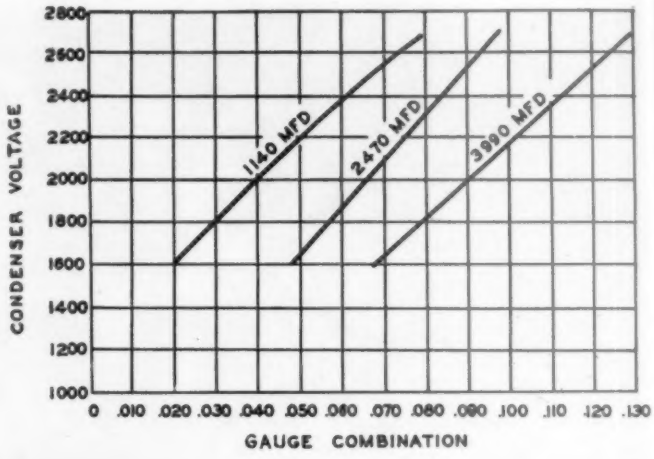


Fig. 1—Approximate voltage and capacitance settings on electrostatic-type stored energy machines for welding Mg + 1.5 Mn annealed sheet at recommended pressures and tips.

By W. S. LOOSE
Chairman, Magnesium Welding Subcommittee, Aircraft Welding Research Committee, Battelle Memorial Institute

THE SPOT WELDING of magnesium alloys is not a new art. Very much progress, however, has been made in the last several years. Probably the most outstanding advance has been the introduction of new principles of applying the necessary energy. Several machines now on the market are distinctly different in their operation as compared to conventional a-c welders.

Weldable Alloys

The forms most commonly spot welded are sheet and extrusions. Table I shows the magnesium alloys most usually spot welded, their chemical compositions and physical properties. Table II gives typical mechanical properties of these alloys. Sheets are furnished in three alloys and in two tempers: annealed and hard-rolled. Extrusions are furnished in four alloys.

Magnesium products can be supplied with either an oil or a chrome-pickled coating to protect the metal during shipment and storage. For spot-welding applications, the oil coating is recommended since a chrome-pickled-coating must be removed before welding. Complete removal of such a coating is difficult, and incomplete removal will lead to inconsistent welds and much electrode pick-up.

Cleaning Procedure

Material supplied with a protective oil coating should be cleaned in a suitable solvent, followed by a light polishing with a motor-driven wire brush to remove the oxide film in the areas to be welded. The diameter of the wire should be between 0.003 and 0.006 in., and the brush should operate at a peripheral speed of over 2,600 fpm. The pressure applied to the brush and rate of progress over the material should be uniform and just sufficient to remove the coating without appreciable loss of the base material.

Manual cleaning may be performed, using No. 0 steel wool or 160 to 240 abrasive paper. If steel wool is used, care must be taken to free the entire surface from the fine particles of steel which may be magnetically attracted into the welding area. Contamination of a magnesium surface with iron will decrease the corrosion resistance. Stainless steel wool is to be preferred for cleaning because of its non-magnetic properties.

Satisfactory removal of the chrome-pickled finish from the alloy containing 1.5% manganese may be accomplished with a wire brush. On alloys containing aluminum, the etch produced by the chrome pickle is deeper, and it may be necessary to use steel wool to obtain a good spot-welding finish. A satisfactory surface may be produced either manually or by the use of a machine driver wheel surfaced with steel wool.

No satisfactory chemical cleaning method for either chrome-pickled or untreated magnesium alloy sheet is available at present. Hot chromic acid or strong caustic solution will remove the chrome-pickled coating but will leave a hydroxide film on the surface. No technique which will produce satisfactory results has been developed, other than mechanical cleaning.

Spot-Welding Equipment

The essential equipment requirements for magnesium spot welding are a reasonably high current capacity, positive control of pressure and an accurate control of welding time. Equipment in which either pressure or time is manually controlled should not be used. However, equipment suitable for aluminum alloys may be used for both spot and seam welding of magnesium alloys. Machine settings are substantially the same.

Adjustment of the welding machine to the proper setting is a very essential step in the production of consistently strong welds. Tables of

** Abstracted from a paper presented at the annual meeting, AWS, Chicago, Oct. 18 to 21.*

Table I. Compositions and Physical Properties of Magnesium Alloys

Nominal Designation	Chemical Composition Range, % Al	Zn	Mn Min	Solidification Range, F	Thermal Conductivity, CGS Units 100-300 C	Coefficient of Thermal Expansion per Deg F (65-750 F)	Electrical Resistivity Microhm-Centimeters at 68 F
Mg + 1.5 Mn	—	—	1.2	1,184-1,202	0.30	0.000016	5.0
Mg + 3 Al + 1 Zn	2.5-3.5	0.7-1.3	0.2	725-1,170	0.23	0.000016	10.0
Mg + 6 Al + 1 Zn	5.8-7.2	0.4-1.5	0.15	725-1,130	0.19	0.000016	12.5

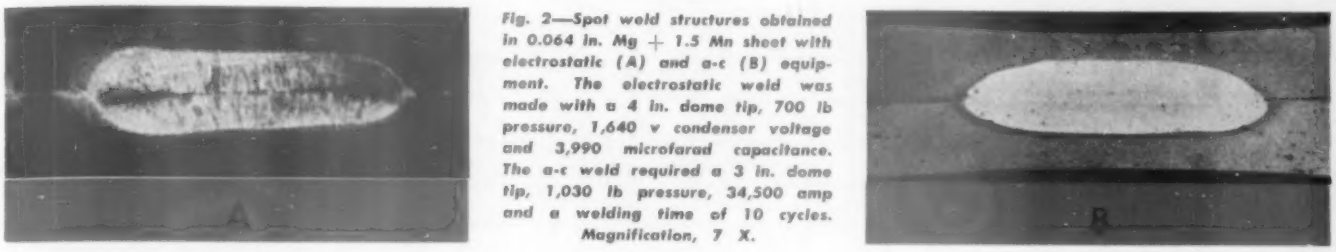


Fig. 2—Spot weld structures obtained in 0.064 in. Mg + 1.5 Mn sheet with electrostatic (A) and a-c (B) equipment. The electrostatic weld was made with a 4 in. dome tip, 700 lb pressure, 1,640 v condenser voltage and 3,990 microfarad capacitance. The a-c weld required a 3 in. dome tip, 1,030 lb pressure, 34,500 amp and a welding time of 10 cycles. Magnification, 7 X.

recommended machine settings for welding two equal thicknesses of material are given later. In using these tables, the first trial welds should be made at somewhat less current or lower voltage values than are given. These values should then be increased in small steps until a weld of the desired diameter or strength is obtained. The diameter of the weld may be determined by tearing apart a welded sample and measuring the size of the buttons which are pulled from one of the parts. A quick section test as described under "penetration" may also be used.

Pressures

The electrode pressures required to weld magnesium alloys vary with the thickness of the sheet and the type of alloy. Machines capable of producing electrode pressures from 300 to 3,000 lb may be used satisfactorily. Pressures which give high strengths and freedom from porosity and cracks should be used. When extremely short welding times (one or two cycles) are used, higher pressures are necessary to prevent flashing. Because of the high coefficient of expansion and the high thermal conductivity of magnesium, a rapid follow-up of the electrode tip is vitally necessary. Air-operated, low inertia, anti-friction type welding heads are essential for quick follow-up.

When pressure is applied to the sheets by the electrodes, a small interface area has intimate contact. As current is applied and the weld slug forms, a pressure ring is produced around the weld slug at the interface. This pressure ring is usually from $\frac{1}{32}$ to $\frac{1}{16}$ in. larger in diameter than the weld slug and increases as the slug increases in size. If the current is applied too rapidly, the pressure follow-up will be too slow, the pressure ring will be too narrow and flashing will result. If the tip contour is too sharp, the pressure ring will be too narrow, and the molten metal as it expands will spit out. This decrease in the volume of metal in the weld slug is one of the causes of cracks. Cracking results in 90% of the welds on Mg + 6 Al + 1 Zn alloy where flashing occurs. Flashing can be detected during welding by a crack or report similar to the firing of a small gun.

Electrodes

As in the welding of all light metals, the selection and maintenance of the electrodes are important. Electrodes are made from hard, high conductivity copper alloys meeting RWMA Class I specification. These electrodes must be water cooled, preferably to within $\frac{3}{8}$ in. of the welding face. Hard-rolled pure copper electrodes are satisfactory in special cases. This material may be used for especially shaped offset electrodes.

Several tip contours have been found to be satisfactory. Among these are the $\frac{1}{8}$ in. to $\frac{7}{16}$ in. by 4 deg flat tip, the 7 deg cone tip, and 2 to 8-in. dome tips. The contour of the electrode is machined on a lathe and is maintained while in the welding machine by dressing with fine abrasive cloth.

Rigidity of both the upper and lower arms during welding is essential in order to minimize deflection of the electrode tips. Excessive deflection causes inconsistent spot strengths, irregularly shaped welds, flashing, cracking, excessive tip pick-up and misalignment of the parts being welded.

Pick-Up

A factor which must always be considered is pick-up. From 100 to 150 welds can be made on hard-rolled Mg + 6 Al + 1 Zn sheet without tip cleaning. On Mg + 1.5 Mn alloy, however, the electrode must be cleaned every 10 to 20 spots. Electrode cooling is an important factor in pick-up, although cooling to excessively low temperatures has a harmful effect. When low temperatures are used, condensation takes place on the electrode tips, materially increasing the electrode-to-sheet resistance during welding; consequently, burning or pick-up

Table II. Mechanical Properties of Mg Alloys

Alloy	Condition	Ultimate Tensile Strength, Psi	Yield Point, Psi	Elongation in 2 in., %
	Sheets			
Mg + 1.5 Mn	Annealed	33,000	18,000	17
	Hard rolled	37,000	24,000	10
Mg + 3.0 Al	Annealed	37,000	21,000	21
+ 1 Zn	Hard rolled	43,000	33,000	10
Mg + 6 Al	Annealed	42,000	26,000	16
+ 1 Zn	Hard rolled	45,000	35,000	9
	Extruded Shapes and Structural Sections			
Mg + 1.5 Mn	As extruded	36,000	20,000	9
Mg + 3 Al + 1 Zn	As extruded	37,000	24,000	15
Mg + 6 Al + 1 Zn	As extruded	42,000	25,000	16
Mg + 8.5 Al + 0.5 Zn	As extruded	45,000	29,000	13

Table III. A-C Settings for Annealed Sheets

Thickness, Inches	Time, Cycles	Pressure, Pounds	Current, Amp	Shear Strength, Lb per Spot
		Mg + 1.5 Mn Alloy*†		
0.020	3	550	22,000	90
0.040	6	750	26,000	250
0.064	10	950	30,000	480
0.081	12	1,000	33,000	710
0.128	15	1,200	43,000	1,350
		Mg + 3 Al + 1 Zn Alloy†‡		
0.020	3	600	17,000	130
0.040	4	750	22,000	330
0.064	5	900	28,000	720
0.081	6	1,000	30,000	980
0.128	8	1,200	33,000	1,350

* Electrode diam of $\frac{5}{8}$ in. is satisfactory for all sheet gauges up to and including 0.081 in. Above this thickness, a diam of $\frac{3}{4}$ in. is recommended.

† A 7 deg cone for both top and bottom tips is recommended for thicknesses of 0.040 in. and over. Under 0.040 in., a 7 deg cone top tip and a flat bottom tip are recommended.

‡ Electrode diam of $\frac{5}{8}$ in. is satisfactory.

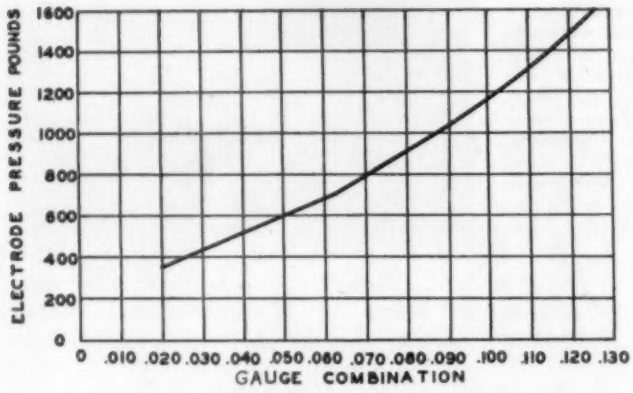


Fig. 3—Recommended electrode pressures for spot welding annealed sheet of Mg + 1.5 Mn.

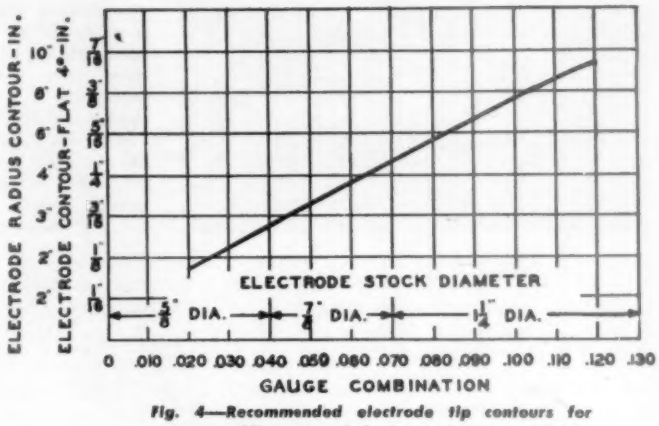


Fig. 4—Recommended electrode tip contours for spot welding annealed sheet of Mg + 1.5 Mn.

takes place more rapidly. For best results, the tip temperature should be as low as can be maintained without condensation of moisture on the electrode.

A simple device can be employed to maintain the electrode temperature as nearly as possible at room temperature. This consists in governing the water supply to the electrodes by means of a solenoid valve and time relay which are actuated by the welder control.

A-C Equipment

Control of current is obviously important and is usually effected on a-c machines by an auto-transformer. In addition, a phase-shift device is frequently employed in the primary line to provide a more delicate adjustment. By these methods the current may be varied over a relatively wide range.

Time of current through the weld is also an important factor. Welding times of less than 3 or more than 30 cycles are very seldom used in welding magnesium.

It is perhaps needless to point out the effect on weld strength when line voltage varies. Automatic phase-shifting devices on the supply line are being successfully used to keep the line voltage constant. When several machines draw current from the same supply line and there is danger of the line voltage dropping below normal, a non-firing device or signal should be employed to either prevent welding or indicate that a poor weld has been made.

Table III shows the machine settings for spot welding typical thicknesses of Mg + 1.5 Mn sheet and Mg + 3 Al + 1 Zn sheet. The approximate spot shear strength values which might be anticipated are also given.

Stored Energy Equipment

In the electrostatic-type of stored energy equipment, condenser capacity is an important factor in determining the weldable gauges in any material. A versatile machine suitable for welding magnesium alloys should have condenser capacities varying from approximately 200 microfarads for welding gauges 0.016 in. thick up to 4,000 microfarads for welding gauges 0.125 in. thick. Fig. 1 gives approximate capacitance and voltage settings for Mg + 1.5 Mn sheet. The transformer-turns ratio not only varies the current peak during welding on condenser-discharge machines but also varies the time of discharge through the weld. A low-turns ratio results in a short welding time (0.01 to 0.05 sec) while a high-turns ratio results in a somewhat longer welding time (0.05 to 0.13 sec). Best welding results on magnesium have been obtained using the higher-turns ratios (360:1 and 480:1). Short welding times tend toward flashing and resultant cracked welds.

In general, electromagnetic stored energy machines operate the same on magnesium alloys as do the electrostatic types. One exception is that lower pressures are employed during actual welding, although the machines are equipped with rapid pressure follow-up. Typical machine settings for welding equal gauges of alloys containing Mg + 1.5 Mn, Mg + 3 Al + 1 Zn and Mg + 6 Al + 1 Zn are given in Table IV. These data will serve as a guide for the settings to be used on intermediate sheet thicknesses.

The Mg + 6 Al + 1 Zn alloy and the Mg + 3 Al + 1 Zn alloy are both easily spot welded, but the Mg + 1.5 Mn alloy is more critical from the standpoint of electrode pick-up. Fig. 2 (*A*) shows a typical spot weld in the last mentioned alloy, produced by electrostatic equipment. The line through the center of the weld slug is the junction of the grains as they grow from the edge of the weld to the center upon solidification. The

Table IV. Welding Settings for Electromagnetic Machines

Sheet Thickness, Inches	PRESSURE, LB			HEAT						Tip Radius, Inches
	Precompression	Weld Pressure	Forge Pressure	Preheat	Primary Current, Amp	Delay before Charging, Cycles	Time of Recompression, Cycles	Poles	Cylinder	
				Mg + 1.5 Mn						
.040	400	400	1,200	with	175	10	30	8	2	4
.064	580	580	1,740	without	300	10	30	8	2	4
.125	1,900	1,080	4,750	with	725	20	30	16	2	4
				Mg + 6 Al + 1 Zn						
.040	500	500	500	without	160	10	30	8	1	4
.064	480	480	480	without	215	10	30	8	2	4
.125	3,216	3,216	3,216	with	725	20	30	16	2	4
				Mg + 3 Al + 1 Zn						
.064	560	560	1,680	without	200	10	30	8	2	4

Table V. Effect of Annealing Spot Welds

(0.081 in. annealed sheet of Mg + 1.5 Mn alloy)

	Breaking Load in Pounds			
	As-Welded		Annealed: 600 F for 2 Hr	
Spec. No.	Shear	Tension	Shear	Tension
1	440	245	815	309
2	442	213	730	305
3	432	195	590	293
4	522	210	657	281
5	267	192	710	295
6	480	221	683	333
7	466	236	742	327
Average	464	216	718	306

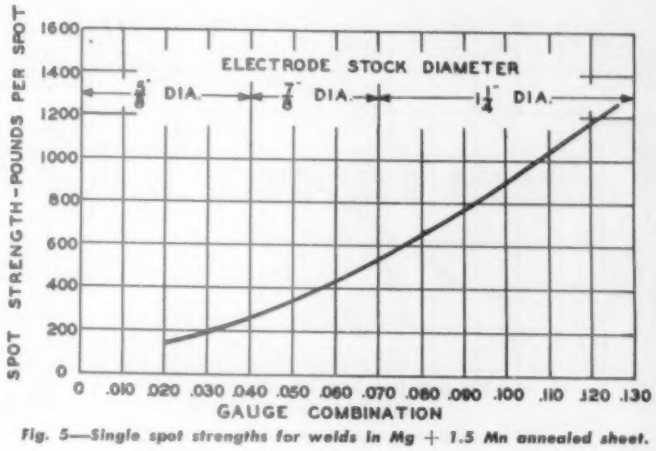


Fig. 5—Single spot strengths for welds in Mg + 1.5 Mn annealed sheet.

strength properties are not affected by this junction line. Fig 2 (*B*) shows a typical spot weld in this alloy using a-c equipment. The centrally located growth line is not noted on a-c produced welds.

Dissimilar Alloys

Dissimilar magnesium alloys can be spot welded together, but consistency in strength is more difficult to obtain than when welding alloys of the same composition. In attempting to weld dissimilar alloys, the solidification ranges, the thermal conductivities and the electrical conductivities are the primary factors which must be considered. Alloys with similar physical properties weld together more easily than alloys of unequal physical properties such as a weld between Mg + 1.5 Mn and Mg + 6 Al + 1 Zn.

Properties of Spot Welds

Soundness of Welds: Sound spot welds are a primary requisite in any structure. Correct welding current is best determined by test welds in which the shear strength, shape of weld and penetration of weld are within specified limits. Fig 3 shows recommended pressures and Fig 4 shows recommended tip contours for spot welding two gauges of equal thickness of annealed Mg + 1.5 Mn sheet.

Shear Strength: Fig 5 shows design strength values which may be obtained by using the recommended tip sizes, pressures and current adjustments. Weld strengths have been assumed as the shear strength which will load the surrounding sheet as much as possible. In thin gauges, this is recognized as welds that fail by tearing. As sheet thickness increases above 0.040 in., weld failures become more typically shear, with a slight tearing of the sheet adjacent to the weld before the shear failure takes place.

Penetration: The weld penetration, as well as the diameter of the weld, may be ascertained by cutting a cross-section through the weld, finishing this surface with a fine file or emery cloth and then etching for 10 sec in a 10 to 50% solution of acetic or tartaric acid. This etch will darken the weld zone sufficiently to make it possible to measure weld diameter and penetration into each piece. The penetration should be not less than 30% nor more than 80% into each of the parts welded. It may be increased on only one of the parts by decreasing the radius of the electrode used against that part.

Flashing, Surface Heating, Pick-up: Flashing of weld metal between the sheets may be eliminated by increasing the welding pressure, decreasing the welding current, increasing the pressure and current or by increasing the radius of the electrode and increasing both the pressure and current. In some cases, a more thorough cleaning of the material may be necessary to completely eliminate flashing. The impression on the sheet of a greasy finger may be sufficient to result in spitting.

Surface heating and pick-up by the electrodes are corrected in the same manner as flashing.

Cracking and Porosity: Radial cracks in the weld are corrected in the same manner as are flashing, surface heating and pick-up. These corrections must be correlated with further examination of the weld diameter so that a lowering of the shear strength does not occur.

Cracks and porosity of spot welds are detectable by either microscopic examination of the weld or by standard X-ray practice or both. Fine grain film is desirable for X-ray examination. Cracking is no great problem on Mg + 1.5 Mn, but Mg + 6 Al + 1 Zn and Mg + 3 Al + 1 Zn alloys are susceptible to cracking. It may, however, be eliminated by adjustment of pressure, current, tip contour or insuring clean surfaces of the sheet.

Indentation: Electrode indentation and surface appearance are functions of tip contour, pressure and current. In order to eliminate tip indentation, a flat tip may be used against the outside surface of the part welded. Gauges up to 0.064 in. can

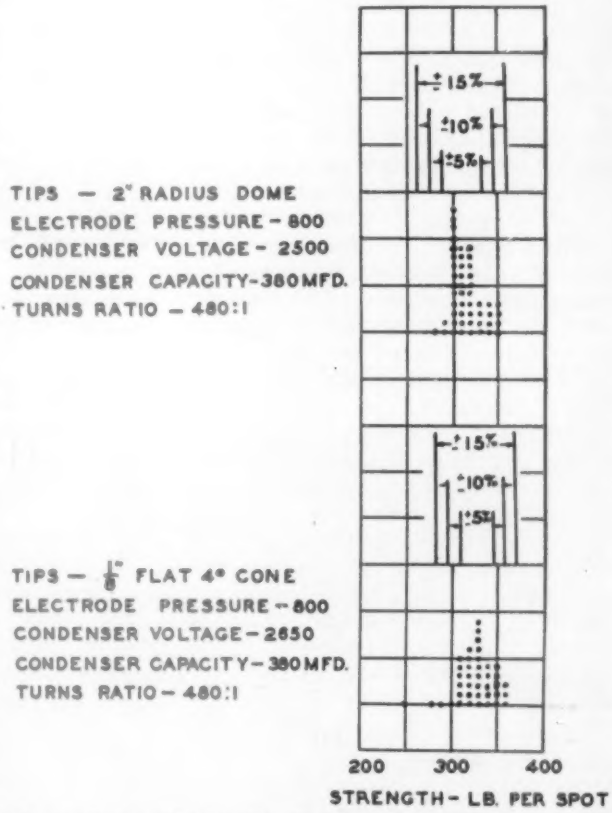


Fig. 6—Spot weld dispersion chart showing consistency on hard-rolled sheet, 0.032 in. thick, of Mg + 6 Al + Zn alloy, using two different electrode tip contours on a condenser-discharge machine.

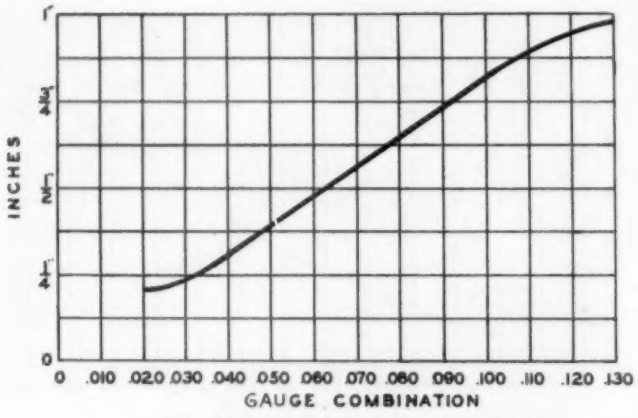


Fig. 7—Recommended minimum spot spacing for Mg + 1.5 Mn and Mg + 6 Al + 1 Zn.

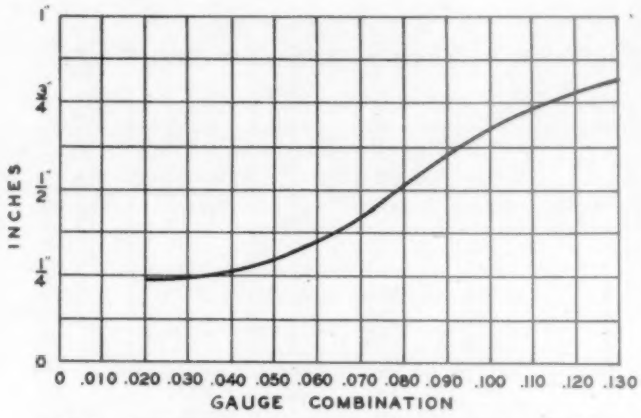


Fig. 8.—Recommended minimum edge distance, center of weld to edge of sheet, for alloys Mg + 1.5 Mn and Mg + 6 Al + 1 Zn.

be welded in this manner. Beyond this thickness, the weld slug moves upward in the sheet toward the electrode with the sharper contour.

Unequal Sheet Thickness: When welding unequal sheet thicknesses, it is important that the electrode with the larger contact area be used against the thicker material. If this is not done, there is a chance that a weld with no penetration or with insufficient penetration into the thinner sheet will be made.

Strength Consistency: Consistency of spot-weld strength is a function of sheet cleanliness, machine variables, tip deflection and proper electrode cooling. For consistent spot welds, these variables must be controlled. Fig 6 shows consistency values which were obtained under standard production methods. The sheet was cleaned with a wire brush, and the spot welds were made continuously along two sheets lapped 2 in. with spots spaced at 1 in. The sheets were cut into test sections and pulled on a tensile testing machine.

Tip Contour: Spot strength is a function of tip contour, pressure, current and resistance. Exploratory work on tip contour has resulted in the selection of two types—the 4 deg flat electrode (the diameter of the flat is dependent upon the sheet thickness being welded) and the common dome tip with the radius dependent upon the sheet thickness. Seven deg cone tips may be used but experience has shown that these tips will rapidly assume the shape of a large radius dome. The 4 deg flat tip not only gives a minimum tip impression but also provides a good hold-down pressure around the weld slug to prevent flashing of metal.

On machines where tip deflection is a problem, dome tips can be used with better strength consistency than the flat tips because the contact areas of the tips against the sheet are more nearly constant.

Annealing Spot Welds: Some tests show a beneficial effect of annealing after spot welding. This may be due to a relief of stresses in the weld. Tests were made on 0.081 in. annealed Mg + 1.5 Mn sheet using the conditions noted. The results are shown in Table V.

Corrosion Resistance

Spot-welded specimens of hard-rolled Mg + 1.5 Mn sheet given a chrome-pickled coating after spot welding were exposed for one, four and eight years to the atmosphere at New Kensington, Pa. The spot welds were not selectively attacked, and there was no significant change in strength of the welds during this period. Accelerated tests in continuous 20% salt spray and alternate immersion in a 3½% salt solution also showed no preferential attack on the weld zone.

On the other hand, accelerated tests on annealed Mg + 1.5 Mn sheet not chrome-pickled after welding and on which copper from the welding electrodes was present showed selective attack of the spot welds.

In view of the fact that copper pick-up reduces the corrosion resistance of spot welds, every effort should be made to minimize this pick-up. Clean material, cool electrodes and frequent electrode cleanings are essential considerations from this standpoint. Copper deposits can be removed by polishing with fine polishing compounds on buffing wheels.

It is sometimes desirable to protect the faying surfaces of spot-welded joints from salt atmosphere corrosion. Although only a limited amount of work on inner-surface protectors has been done, spot-welded joints have been successfully fabricated using semiliquid protectors. The protector must be viscous enough so that when pressure is applied to the spot-weld location, the protecting liquid will be squeezed out from between the sheet at the spot weld, thus giving bare metal contact and relatively low resistance. Welds should be made soon after the application of the material and not more than an hour from time of application to time of spot welding should elapse.

Great care must be exercised in preparing a joint of this nature and frequent tests must be made to check the spot strength and consistency. It is not advisable to subject spot-welded joints prepared in this manner to the 30 min boil in sodium dichromate solution which is required for surface treatment because the inter-surface protectors have a tendency to "bleed" upon prolonged exposure in heated atmospheres. Such conditions, however, are not frequently encountered.

Joint Design Hints

The design of joints for spot welding should receive careful consideration to insure that the parts to be welded can be placed in the welding machine in the proper position for welding. The work should be horizontal and normal to the axis of the welding tips. Only the point to be welded can be allowed to contact the welding machine.

Spot welding requires adequate spacing between the spots and sufficient edge distance to insure good welds. Figs. 7 and 8 show recommended minimum spot spacings and edge distances for the placement of spot welds in magnesium alloy. Where maximum joint efficiency is required, two or three rows of spots should be used, and the spot spacing should be increased until the total strength of the spot welds is approximately equal to the strength of the material welded.

Where unequal thicknesses are to be welded, the thinner sheet should be placed against the tip with the smaller contact area, if possible. Thickness differences greater than two to one are not recommended.

Winning the War on Wear*

In this battle of the production lines, our chief ally is named Hard-Facing. This process enables us to keep equipment in service despite the forces of abrasion and of corrosion, erosion, heat, impact and thermal shock.

TYPE	HARD-FACING MATERIAL	RESISTANCE TO: ABRASION	EROSION	CORROSION	HEAT	IMPACT	THERMAL SHOCK	APPLIED BY	HARDNESS (As Deposited)	TENSILE STRENGTH PSI	SPECIAL PROPERTIES
1	HIGH HARDNESS COBALT-CHROMIUM-TUNGSTEN ALLOY	S	S	S	G	–	–	O-A	54 ROCKWELL C	47,000	WEAR RESISTANCE
								ARC	45 ROCKWELL C		
2	HIGH TENSILE COBALT-CHROMIUM-TUNGSTEN ALLOY	G	S	S	S	S	G	O-A	31-40 ROCKWELL C	105,000	RESISTANCE TO WEAR, HEAT, EROSION, AND SHOCK
								ARC	31 ROCKWELL C		
3	HIGH CHROMIUM IRON ALLOY	G	G	–	–	S	–	ARC	40-45*ROCKWELL C 26-30 ROCKWELL C	40,000	FOR MANGANESE STEEL PARTS
4	RODS WITH TUNGSTEN CARBIDE GRAINS IN A STEEL MATRIX	S	–	–	–	–	–	O-A			FOR EARTH-MOVING AND AGRICULTURAL EQUIPMENT
5	NICKEL-BASE ALLOY (with Cr, Mo, W, Fe)	–	G	S	S	S	S	ARC	200 BRINELL	72,000 to 80,000	RESISTANCE TO THERMAL SHOCK AND HEAT: MACHINABILITY

Fig. 1—Guide to the selection of hard-facing materials. (S) superior; (G) good; (—) not outstanding; O-A, oxy-acetylene; * after work-hardening

By **JOHN A. GALLAHER**
Chicago District Manager, Haynes Stellite Co.

PRESENT operation of equipment 24 hours a day, seven days a week, means that a continuous "war on wear" is necessary in order to reduce down time and to maintain maximum production. To this maintenance war, the welding industry has contributed materially by providing techniques for the application of hard-facing to worn parts.

Hard-facing will not only eliminate the need for a new part—today hard to obtain—but it will add greatly to the part's useful life. This "preventive maintenance" is as sound practice for new as it is for worn parts.

Analysis Comes First

The first step in any hard-facing problem is to make a complete analysis of the particular factors that have caused or will cause the wear. This is by no means simple. It is generally admitted that very little is known about the mechanism of wear, which involves such a large number of interdependent variables that single isolated tests are rarely able to approximate actual service conditions.

Our approach to wear problems should, therefore, be based on actual experience rather than on theoretical predictions which have not been verified. The accompanying chart (Fig. 1) is presented to illustrate what can be done to guide in the selection or elimination of certain types of hard-facing materials. It should not be taken as a set of hard-and-fast rules.

Six Wear Factors

Some of the factors to be taken into consideration when determining the particular hard-facing alloy to use are:

1. Is the part subjected to abrasion?
2. Is it subjected to erosion (the type of wear encountered by the blades of a steam turbine)?
3. Is it subjected to corrosion? From what acid or corrosive material?
4. Is it subjected to heat? At approximately what temperature?

**Abstracted from a paper presented at the annual meeting, AWS, Chicago, Oct. 18 to 21.*

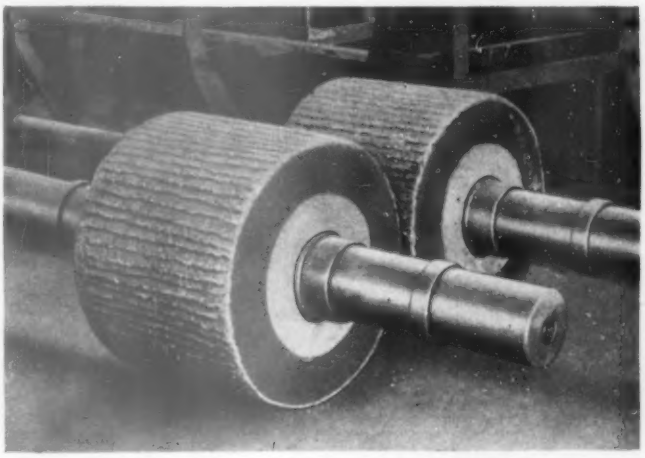
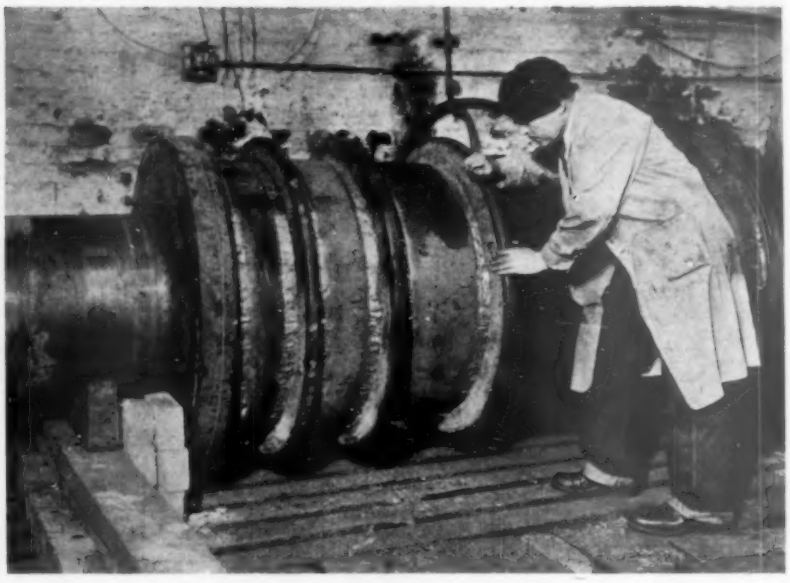
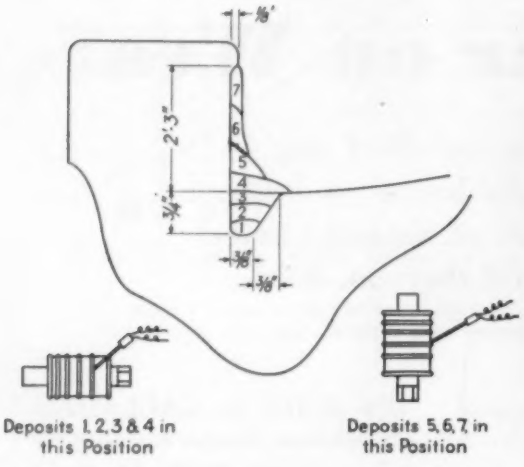


Fig. 2—Steel sand-crusher rolls protected with Type No. 1 rod.

Fig. 3 (right)—When this cogging mill roll was cleaned up, undercutting revealed that the alloy deposit was too shallow. Fig. 4 (below)—The groove for the alloy deposit was redesigned to combat the undercutting found in the roll (Fig. 3).





5. Is it subjected to impact? To what degree?
6. Is it subjected to thermal shock (rapid change in temperature)?

Frequently, more than one of the above factors must be taken into consideration. This introduces a new difficulty. One type of hard-facing material may have superior abrasion resistance but will not withstand severe impact; another may have a good abrasion resistance but will not withstand corrosion. Still another type of hard-facing material may be able to withstand all other conditions except thermal shock. Compromises must therefore be made; some abrasion resistance, for instance, may be sacrificed in order to secure superior resistance to thermal shock. With the aid of the chart a quick check can be made to determine which of the five basic hard-facing types will be best suited to any particular combination of wear factors.

When there is a choice of base material, consideration should be given to the service to which it is subjected. A base material of high strength must be used if the part is subjected to impact and heat. On hot-punching work, for instance, where considerable impact is involved, it is possible to make a punch of SAE 1020 steel if no thicknesses greater than ¼ in. are to be punched. But high-strength base material must be used for the punch body if material several inches thick is to be punched.

Applying Hard-Facings

Certain types of hard-facing materials can be applied only by the oxy-acetylene method, others only by the metal arc or by atomic-hydrogen welding. Some will work readily with any of these three methods. It is necessary to know which hard-facing materials will crack or have a porous structure when applied by the arc and which cannot be gas welded with entire satisfaction.

The following questions should be carefully answered before determining the welding procedure:

1. What is the analysis of the base material?
2. Is it necessary to preheat the base material? Is it necessary to stress relieve after hard-facing?
3. How should the surface be prepared?
4. What welding process should be used?
5. Would a casting or strip of hard metal brazed to the part be more economical than hard-facing?

Among the factors to be taken into consideration in the preparation of a part for hard-facing, the following are of the most importance:

1. Should the part be preheated to prevent cracking or to help control warpage?
2. Has sufficient allowance been made to compensate for distortion and shrinkage?
3. Has the part been properly cleaned?

Shrinkage Mathematics

One problem encountered was to apply hard-facing to a 5 in. OD sleeve having a wall thickness of ½ in. so as to finish with a deposit 0.100 in. thick and still retain the 5 in. OD. Common sense would say that the sleeve blank should be prepared by machining it to 4.800 in. OD in order to allow 0.100 in. on each side for the hard-facing deposit. However, experience proved that the sleeve should be machined to 4.880 in. OD (0.080 in. larger than would seem correct) and a deposit of hard-facing alloy of about ⅛ to 3/16 in. then applied on the surface. While cooling from the hard-facing application, the part so shrinks that when it is ground to a 5 in. OD, the deposit will be found to be just about 0.100 in. thick—the oversize allowance being absorbed by shrinkage. The hole will have become smaller, but it can, of course, be bored to the correct size.

Counteracting Distortion

Another hard-facing problem was provided by facing the cutting edge of a long blade. If laid flat and hard-faced, the blade would distort by bowing during the hard-facing operation. Any subsequent attempt to straighten this blade would put the hard-facing deposit under tension, and cracking would undoubtedly result. The solution was simply to put a reverse bend in the part before hard-facing by clamping the ends of the blade to a table with a support under the center of the blade. As it cooled, the blade pulled itself almost straight,

Fig. 5—Hard-faced punches used for piercing 75 mm shells.

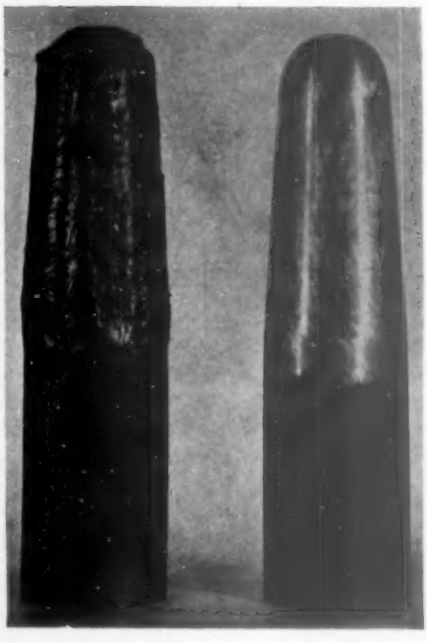


Fig. 6—The life of this lime blower impeller (used in sugar processing) was increased almost tenfold by careful hard-facing.

and the final mechanical straightening required put the deposit under compression rather than tension.

Preheating is often necessary on large parts and parts having a deposit in the form of a ring in order to prevent cracking. When a large steam valve disk is hard-faced, for instance, uniform preheating of the entire disk reduces the welding time and prevents cracking of the hard-faced deposit.

Hard-Facing Advantages

The chief advantages of hard-facing are:

1. Longer life of equipment.
2. Fewer replacements with resultant savings in labor charges and lost production time.
3. Utilization of low-alloy metal as the base for wearing parts.
4. Salvaging or reclaiming of worn parts.
5. Savings in power consumption.
6. General increase in operating efficiency.

The hard-faced part (especially if it is a part with cutting edges) remains sharp longer, thereby reducing the power consumption of equipment. Hard-facing also increases production and saves time by reducing the number of equipment shutdowns. If, for instance, a hard-faced part will last four times longer than the original part, three shutdowns are eliminated. In some cases, the hard-faced part will also make possible a speed-up of equipment and will thus contribute in another way to increased production.

Another outstanding feature of this method is that parts can be repeatedly hard-faced. In one drop-forge plant in the Chicago area, the same hot-flash trimming die has been maintained in operation by resurfacing for over eight years. Even though the cost of initial application and grinding may approximate the cost of a new part, the additional life obtained will make the ultimate cost substantially lower.

Hard-Facing Worn Parts

To illustrate the use of the chart, Fig. 1, as a guide let us first consider coal undercutter bits which are subjected to severe abrasion and must resist tremendous wear. The chart shows two materials—No. 1 and No. 4—which might do. Both have been tried; both are suitable in certain formation. However, the No. 4 alloy is the more wear-resistant and is by far the more widely used.

These bits are placed on a rotary jig and are tipped with just a drop of the hard-facing alloy. One operator can do from 600 to 700 bits an hour.

Another example is the selection of rod for hard-facing manganese steel crusher mantles. One mantle had a life of approximately six months; at the end of this time the 2½ in. wall thickness was practically worn through. The principal consideration was severe impact upon the face of the mantle although the abrasion was also quite severe. Since the base metal, manganese steel, requires deposits up to 1½ in. in thickness in places, Type No. 3 alloy is the most suitable for this application.

One of these castings was reclaimed by building up the worn surface with this alloy, using the metal-arc process. Ninety pounds of the alloy were applied in 25 hours. The total cost of rebuilding, including overhead, amounted to slightly more than 25% of the cost of a new mantle. At the end of four months and after crushing 28,000 tons of copper pyrites, this part showed only $\frac{5}{32}$ in. of wear. Three more mantles have been reclaimed and all have shown that their life expectancy is twice that of the unfaced mantles.

Steel sand-crusher rolls (Fig. 2) in similar service were hard-faced with an alloy of Type No. 1. Because these rolls are crushing sand, the principal wear factor is abrasion, impact being of little consideration. Type No. 1 rod was applied by the metal-arc process and kept the rolls in service for over a year.

Resistance to Heat

We are all interested in the techniques used by our Allies to reduce down time and save metal. The following is a description of a cogging roll used in an English steel mill:

"In hard-facing a pair of cogging mill rolls, one of which is shown in the illustration (Fig. 3), the groove for the alloy deposit was designed as shown in Fig. 4. The sketch shows the details of this groove and also the number of beads required. This number will vary with the skill of the operators, but the seven shown are probably the minimum.

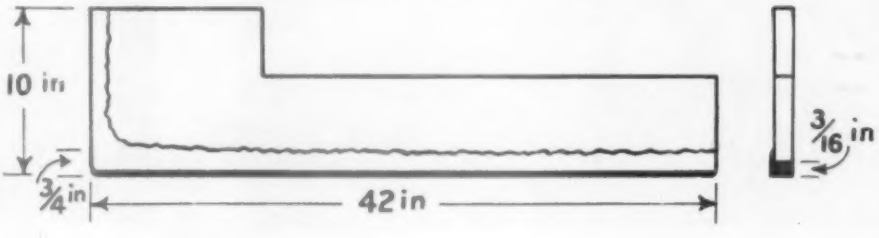
"The diameter of the rolls at the base of the flange was 36 in. They were made from steel with 0.35 to 0.45% carbon and 1.0 to 1.5% nickel. They were preheated to 200 F, and hard-facing was carried out with ¼ in. diam coated rod (Type No. 2), using approximately 200 amp direct current with the polarity reversed. The deposit was laid down in the groove by working the arc from a semi-vertical position since this position was found to produce a smoother deposit and one more free from cracking. The roll was stood on end for hard-facing the flanges.

"The deposits were machined with tungsten carbide tools; rough machining was done at one revolution in 80 seconds, finishing at one revolution in 40 seconds. When the last report was made available, these rolls had made four runs and had rolled a total of 147,000 tons. They are still in service and will last for some time yet. Standard alloy steel cogging rolls have a life of approximately 90,000 tons."

Resistance to Thermal Shock

Hot-trimming dies are used for trimming the flash from ring gears and many other forgings of both plain and alloy steel. Since most of the dies can be hard-faced with an alloy of Type No. 2, this type has been most widely used. More recently an alloy of Type No. 5 has been used for hard-facing hot-work punches and dies, es-

Fig. 7—The blades of this mixer for "mulling" foundry sand were successfully hard-faced by using this set-up. Lower edges of the blades receive the heaviest wear.



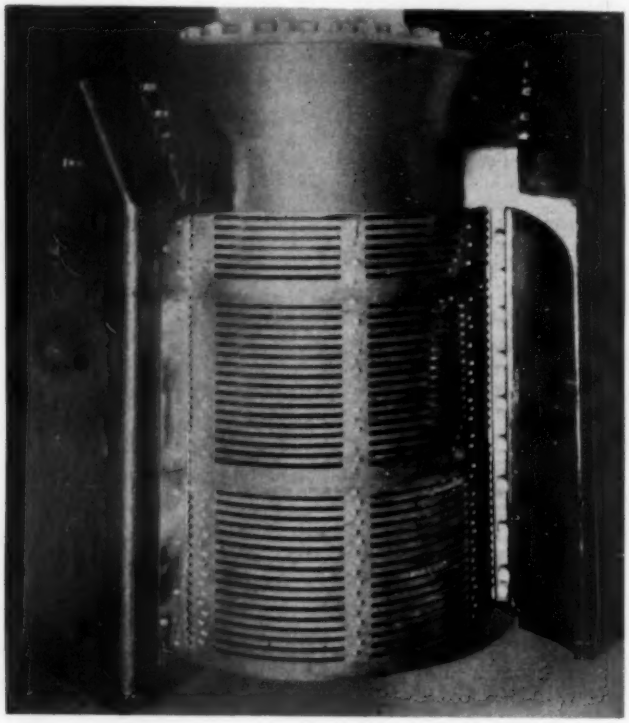


Fig. 8 — A comminutor (large rotary pump and cutter device) for treating sewage. The combs and teeth are hard-faced.

pecially when the operation involves thermal shock. Type 5 alloy can be machined, is applied with the metal-arc and requires no heat treatment.

Fig. 5 shows piercing punches used for punching 75 mm shells. Scrap punches were used and were machined 1/16 in. undersize on the diameter and nose before hard-facing. Study of the manufacturing operation showed that the punch had to withstand heat, impact and thermal shock. The heat was excessive because of the depth of the hole being pierced, and the punch was immersed in water after each piercing operation. Naturally, thermal shock occurred.

A review of available hard-facing materials showed only two that might withstand this thermal shock—alloys of Types No. 2 and No. 5. Both were tested, and No. 5 was found to be successful. A 5/32 in. rod was applied by the metal-arc process, and the deposit was machined to size with a high-speed-steel tool.

Four Times as Many Shells

This hard-faced punch produced 2,000 shells during the operating life of the hard-faced surface. It was buffed every 500 shells during the run to improve the piercing action. The previously used tool-steel punch had produced but 450 shells during its useful operating life and had had to be buffed every 150 shells. Hard-facing has been reapplied to this part several times since the operation was first tried, and the original punch body is still in use.

Still another successful application of Type 5 alloy was on a forming and piercing punch and die for forging bomb booster caps.

Abrasion and Corrosion

Referring again to the chart (Fig. 1), we find that we have discussed applications designed to overcome wear from abrasion, heat, impact and thermal shock. Fig. 6 shows a part which was subjected to wear from abrasion and corrosion—a lime blower impeller used in sugar processing. Here Type No. 1 rod was used to combat the severe abrasion and the moderate corrosion.

The blades, each 16¼ in. wide, had to be flat and the blower well balanced when the hard-faced blades were assembled to the spider. Distortion could not be tolerated. To counteract warpage, each blade was clamped to a back-up plate with spacer bars inserted to give a reverse bend. When the clamps were removed, the blade sprang back to less than 1/32 in. out-of-true. The blower was less than one ounce out of perfect balance after assembly, and this was adjusted when applying hard-facing rod to protect the rivet heads from wear. Hard-facing kept this blower in service 316 days; before hard-facing was adopted, the average life of a blade was 34 days.

Greatest Wear Resistance

Where a part is not subjected to erosion, corrosion or heat—and does not need to be extremely smooth nor take a high polish—the greatest wear resistance can be obtained with hard-facing alloys of Type No. 4, which consists of grains of tungsten carbide applied in a matrix of steel. An example is provided by a commonly used type of mixer for "mulling" sand in foundries. This consists of two large rollers and two plows or blades which rotate with the rolls, mixing the sand and guiding it under the rollers. A layer of Type No. 4 rod about 3/16 in. thickness was applied to the lower edge of the blades where the wear was heaviest, while the front of the blades, which receive somewhat less wear, were protected with a coating of Type No. 1 hard-facing alloy ¾ in. wide. The set-up is shown in Fig. 7.

The life of these mixer blades was increased from about 3 to about 12 days, and they were hard-faced in the same manner again and again. The power required to run the machine was reduced by about one-third because the plows stayed sharp and cut through the sand more easily. This

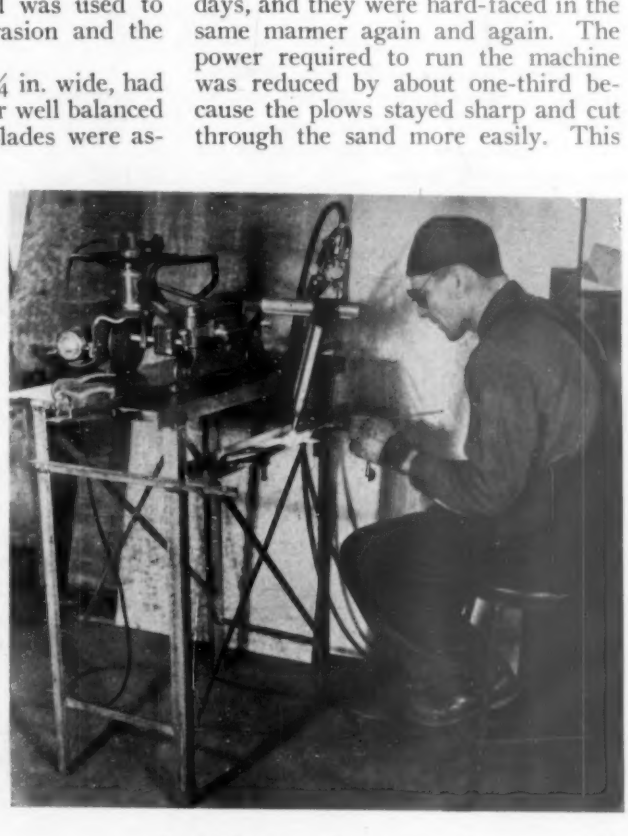


Fig. 9—This portable oxy-acetylene cutting machine was successfully adapted to a semiautomatic hard-facing operation on knives for ensilage cutters.

Fig. 10—Hard-faced parabolic disk and seat on a flow-control valve handling 350,000 lb of steam per hr at 750 F, 400 psi.

example shows that there is no reason why different wearing surfaces cannot be hard-faced according to the particular needs of each as evidenced by an analysis of the job.

Resistance to Corrosion

Since corrosion varies from mild to severe according to the chemical or its concentration, selection of the hard-facing alloy to combat a specific corrosive condition can best be made after references to tables of corrosive action on metals. Most hard-facing alloys will resist average corrosion, but there are some special conditions which some of them cannot resist.

Fig. 8 shows a comminutor—large rotary pump and cutter device for treating sewage. Sludge passing through the openings is cut into small pieces to facilitate the chemical action which follows in the treating process. Wood, cloth, vegetable matter, rubber and even metal pieces are sometimes encountered, and the teeth and combs must be of sufficient hardness to resist the wear from these materials. Combs for this machine were hard-faced with Type No. 1 hard-facing rod and ground to size. The excellent service which resulted (in comparison with ordinary steel combs) caused the manufacturer to standardize on hard-faced combs for the machines which he now builds.

Semiautomatic Hard-Facing

Speed-up of the hard-facing application is receiving much attention in these days. One plant adapted a portable-oxyacetylene cutting machine (Fig. 9) to mechanize and speed the application of hard-facing to knives for ensilage cutters. The flame travels along the blade, which is held in a jig, and the operator feeds the hard-facing rod into the flame by hand. A foot switch stops and starts the machine. Blades hard-faced by this semiautomatic set-up will last six weeks without sharpening whereas carbon steel knives had needed sharpening every eight hours.

Resistance to Erosion

The hard-facing material used upon valves for steam plant service must meet these requirements:

1. Be hard—and also abrasion- and erosion-resistant—even at red heat.
2. Take a high polish and have a low coefficient of friction.
3. Resist scoring, galling, seizing and wire-drawing.
4. Remain free from corrosion and pitting.

Experience has shown that Type No. 2 alloy is ideal for this service. One example of the outstanding service life which this application gives is provided by a parabolic disk and seat on a 16 in. flow-control valve (Fig. 10). These were hard-faced with Type No. 2 alloy. The maker of the valve found this particular alloy satisfactorily resistant in a service which involved the handling of 350,000 lb of steam per hour at a temperature of 750 F and a pressure of 400 psi.

Large production requirements made it desirable to mechanize some phases of the above application. Fig. 11 shows the rotating jig on which the valve part is placed after it has been taken from the preheating furnace. The use of this fixture speeds up the application of hard-facing alloy, while further savings in time are obtained by machining instead of grinding the surface of the valve. A tungsten carbide tool is used in this machining operation at a surface speed of 25 to 40 surface feet per minute.

Manufacturing of uniform hard-faced parts in large quantities has brought about the need of reducing the cost of the hard-facing operation. An automatic hard-facing machine, was designed for applying hard-facing metal to the surface of high-temperature high-pressure steam gate valve seats. This machine can accommodate parts with diameters from 6 to 24 in. It produces a deposit 1¼ in. wide and ⅛ in. thick at a rate of approximately $\pi(3.14+)$ inches per minute; thus a 6 in. ring is completed every 6 minutes, an 18 in. ring every 18 minutes, etc. Two preheating torches render preheating furnaces unnecessary, and Type No. 2 hard-facing rod is fed automatically. Use of this machine has resulted in savings of 30% in metal deposited and 20% in machining time for finishing the surfaces.

Other automatic hard-facing machines are being developed where production is high enough to warrant their application. Besides effecting savings in material and time, such machines also eliminate operator fatigue and produce parts of uniformly high quality.

Fig. 11—A rotating jig saves time in the hard-facing of valve parts.

★ PRODUCTION

Warehouse Turns Fabricator

By J. G. MAGRATH
Applied Engineering Dept.,
Air Reduction Sales Co.

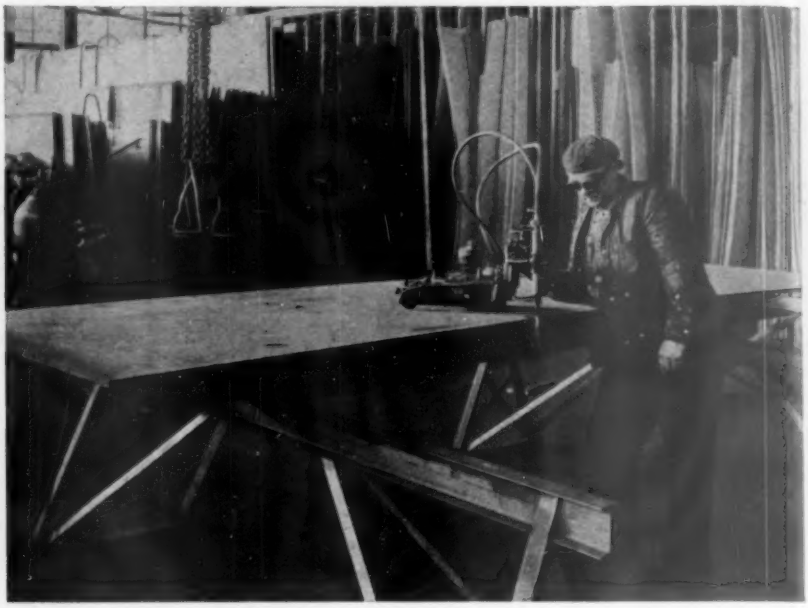


Fig. 1—The first cutting machine installed at Avery and Saul was this small machine for simple straight line and circle cutting to customers' dimensions.

Flame-cutting and welding are the twin keys to a business handling over 6,000 tons of steel plate annually. Starting as a steel warehousing organization in 1911, Avery and Saul now devotes itself entirely to design and production of flame-cut and welded machine parts.

OFTEN the small industrialist, overburdened with war production, has been forced to expand greatly his production facilities. In many instances, materials and machine equipment cannot be secured. Accordingly, he has had to accelerate the tempo of every operation in his plant and with the same tools produce two and often three products where but one had been made before. In all probability, he must also be able to produce items of entirely different nature from those that formed the backbone of his company's business during peacetime days.

Shape-Cutting Demand

The Avery and Saul Co., a steel warehousing organization founded in 1911, found itself in just such a position. Early in 1936, it became evident that warehousing alone would not completely service customers' requirements. An increasing number of inquiries were being received for shapes and for plate cut and formed to other than standard size. Accordingly, the lightweight motor-driven flame-cutting machine shown in Fig. 1 was added to the equipment. This machine made possible straight line and rectilinear plate cutting to length and to width, circle and arc cutting, and simple beveling on both straight line and circular work. Straight line beveling could be accomplished quickly and to given tolerances by setting the cutting torch at an angle while the machine ran on a track parallel to the edge of the plate.

Larger Apparatus

As welded fabrication became more commonly accepted, the company, aware of the growing customer interest in this field, installed the larger gas-cutting apparatus shown in Fig. 2. This machine has four gas-cutting torches, a centralized gas control unit and a manual tracing device. It was now possible to do multiple oxy-acetylene cutting of four duplicate units simultaneously by making one pass over a drawing or template mounted on the tracing table.

Fig. 2—Flame-cutting four bearing blocks simultaneously on a multiple-torch machine, using a drawing template and manual tracer. Each block is 2¼ in. thick, 7 in. square and has a 4¼ in. ID hole to be cut.

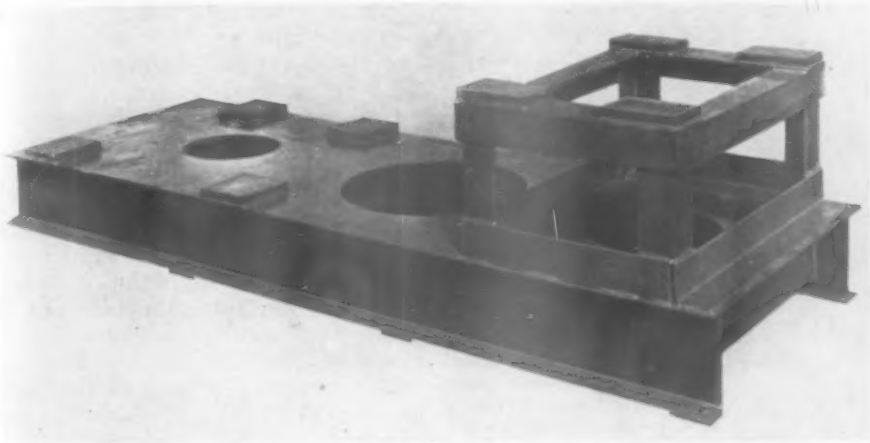


Fig. 3—Flame-cut and arc-welded motor base made of ½ in. plate and channel side frames. This is an example of Avery and Saul's earliest welded fabrication.

Motor Bases and Other Parts

An example of early welded fabrication done at this time is the wholly flame-cut and arc-welded motor base shown in Fig. 3, which was made from ½ in. plate with structural channel side frames and heavy base pads. The multiple flame-cutting machine accomplished the operation of sizing and circle-cutting the floor plate with one set-up. Windlass machinery arms and parts also exemplify the scope of the company's flame-cutting operations during this period. Such parts, made from flame-cut carbon and alloy steel, were strong and lightweight. They were shaped in multiple by employing a manual tracing device that followed a paper template.

The interesting and unusually shaped railroad chocks shown in Fig. 4 were also produced during this period. While odd in contour in one plane, these chocks presented a very simple problem for machine flame-cutting. They were cut, four at once, from 4-in. plate. By "nesting," the greatest number of parts was secured from the least area of plate surface with minimum waste.

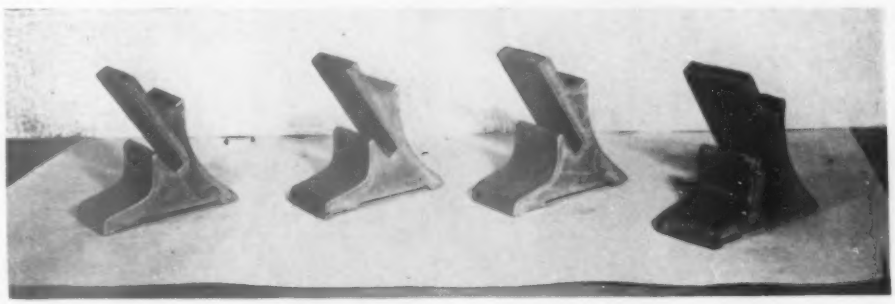


Fig. 4—These unusually shaped railroad chocks were cut from 4 in. plate, in multiple sets of four, with the machine shown in Fig. 2. The design readily lent itself to nesting.

Repair Parts Flame-Cut

As our National Defense Program expanded, local industries found increasing difficulty in securing replacement parts. Recognition of the widespread acceptance of flame-cutting fabrication was evidenced by a profusion of calls for flame-cut duplicates of wornout or broken parts. In emergency replacement services, the speed and accuracy of oxy-acetylene flame-cutting become obvious advantages. An example is provided by a rocker shaft for a metal stamping machine, which broke down at a time when no spare was on hand. Within six hours the needed blank had been shaped from 5½ in. plate.

It frequently happens that a sprocket, gear or a pinion will break, causing the crippling or complete shutdown of an entire plant. Quick replacements are possible by means of the cutting torch.

Heavy Cutting Work

An increasing demand for parts of heavy thicknesses began to occur. Stock dimensions were raised up to 6 in. thickness and even heavier for special jobs. The accuracy of dimension and adherence to contour possible with the machine-cutting process are qualities not sacrificed in heavier cutting. A typical example is the 14 in. diam gear in Fig. 5, which was cut from 6½ in. plate. The original wooden pattern, shown at the right, was employed as a guide for dimensions only. After cutting, no machining of this gear was required.

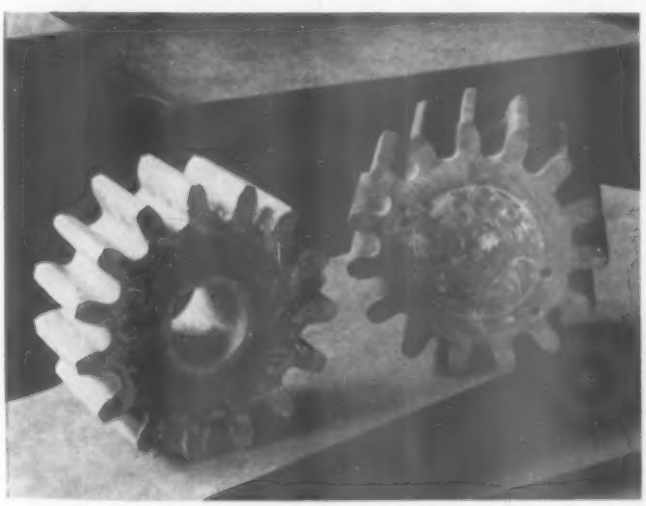


Fig. 5—The original wooden pattern on the left was employed as a dimensional guide for flame-cutting from 6½ in. plate the 14 in. diam gear shown on the right. No machining was required after cutting.

Add Welding Department

The actual welding fabrications were first sublet outside, but as the volume steadily increased, it became evident that other provisions were necessary. So in 1939 a complete welding department was opened. This department has grown from a single motor-generator set to a total of ten d-c welding generators—four 300 amp and six 200 amp.

An example of the type of welded fabrication being done is provided by the four-ton calender-roll frame shown in Fig. 6. The main frames, 8½ ft high, were cut from 6 in. plate. The bottom and top hubs required 10½ and 12½ in. plate, respectively, which thicknesses were not readily available. These hubs,

Fig. 6—Four tons of plate were used in the construction of this 8½ ft calender-roll frame for a rubber mill. The main frames were flame-cut from 6 in. plate. The bottom and top hubs were made by welding 2½ in. and 4½ in. thick rings to rings cut from 8 in. plate in order to produce hubs of the required 10½ in. and 12½ in. thicknesses.

however, were made with complete satisfaction by welding deeply beveled rings of 8 in. plate to other rings of 2½ and 4½ in. thicknesses. The job was completed in 40 hours over a week-end, and it enabled a large rubber mill to return to operation in less than seven days after the breakdown of the original frame. The alignment was perfect after finish machining, with no distortion present.

An added illustration of the adaptability of flame-cutting and welding to heavy plate is shown by the 8 in. hinge block blanks in Fig. 7. Plate parts as thick as 14 in. have been production-cut and welded at this shop.

Advantages of Welded Assembly

The combined processes permit freedom of machine design never before available. There is little or no danger of internal faults since the welded assembly is virtually a unit of homogeneous rolled plate of high tensile strength. The fabrication procedure allows various grades of steel, meeting specific requirements at different zones, to be combined in one structure. Alloy steel, for instance, may be employed where unusual strength is required and abrasion-resisting steel where continual wear is experienced, both being integrated into the major structure of mild steel. Stress relieving of such welded units makes them readily machinable. Flame treatment after machining may be used to bring out the requisite physical properties of the various steels.

Because of the high tensile strength of rolled steel, considerable weight may be saved through the employment of thin sections without sacrifice in strength. Shaped parts for such welded assemblies may be cut, either singly or in multiple, direct from blueprints. The fabrication procedure is as flexible as are the cutting and welding processes. With the aid of the arc, additional fixtures, brackets, etc., may be quickly and securely affixed. An improved product—stronger, lighter, and streamlined—is made available, while important economies in time, material and labor are effected.

Abandons Warehousing

By 1940 the war was causing considerable change in the warehousing field, and the company made the revolutionary decision to convert its entire organization to welded fabrication and to abandon the warehousing end of the business entirely. Particular effort was expended in broadening the scope of operation to include a range of war production jobs, of which the manufacture of boat deck machine gun mounts provides one example. To supplement the two flame-cutting machines previously described, the large multitorch pantograph-type shape-cutting machine shown in Fig. 8 was added.

A flame-cut and arc-welded gear lapping machine weighing better than a ton provides an interesting study of the product design possibilities in the employment of the combined welding and flame-cutting processes. For the base of this machine, a shell ½ in. thick and partitions were mounted on a heavy bottom formation. Heavier 2 in. thickness were provided for machining tolerances where required.

Stack Cutting

Where a large number of identical parts are to be made in production and such parts are of light gauge metal and of not greater than 6 sq ft in overall area, stack cutting may be economically accomplished as

Fig. 7—Flame-cut hinge block blanks and the scrap of the 8 in. plate from which they were cut.

Announcing

NEW G-R WELDERS for 1944

NEW G-R MODELS 25-C and 35-C. The G-R line for 1944 is complete, with a model for every requirement, operating on all standard voltages. Output range from 100 to 3,000 amperes.

FOR 1944, G-R supplements its present well-established line of transformer-type welders with the "C" models described below:

HIGHER POWER FACTOR . . . Lower input current. Smaller primary service requirements permit use of existing critical power. Power factor correction, standard equipment on all "C" models.

EXTRA-DUTY INSULATION . . . All "C" models Class-B equipped (glass and mica insulation). Assures ability to master adverse welding conditions.

EVERY MODERN FEATURE . . . New housing, all parts readily accessible. New primary switch for convenient control. Indicator permanently mounted on chassis.

and the famous G-R Flux diversion type transformer, providing maximum flexibility, stepless heat control, low maintenance cost, safety for the operator.

Always ahead . . . G-R Welders for 1944 again set the pace in modern design . . . and value.

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P. O. Box 1814, Washington, D. C.

Fig. 8—Discs of 12½ in. diam and 1½ in. thick are being flame-cut four at once on this large pantograph-type machine. A single-torch operation is used in order to cut the fifth disc in each row from the scrap edge.

shown in Fig. 9. The several plates are fitted evenly edge to edge and rigidly clamped together so as to exclude all free air space between them. Welding beads are then run along the edges, uniting the plates into what is practically a solid slab. This may be flame-cut to any pattern; after cutting, a quick blow with the maul will loosen the slab into its numerous leaflike, identical forms.

New Equipment Added

Since the plant was located in a built-up industrial center with erected properties on all sides, Avery and Saul found it impossible to extend their plant area. Ways and means had to be devised to utilize every square foot of space and to double or triple its productive possibilities. A gradual mechanical expansion plan was inaugurated. This expansion provided for new oxy-acetylene cutting and arc welding equipment as well as for three grinders, a drill press, power hack saws, a shear of ⅜ in. by 10 ft capacity, a 700 gallon testing pit, a 16 by 18 by 12 ft sandblast room, two air compressors, and three cranes—of 5, 4 and 2 ton capacities.

Present flame-cutting equipment consists of three single-torch machines, one two-torch machine, two four-torch machines and one larger four-torch machine, the total comprising a capacity of 17 cutting torches. In addition, an adequate number of hand-cutting outfits are provided.

Oxygen and Acetylene

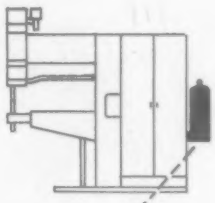
The cutting oxygen is received in trailers of approximately 10,000 cu ft capacity and is delivered to the oxygen supply line through trailer discharge manifolds equipped with regulators. A line pressure of 105 psi is maintained. The oxygen line is of 1½ in. diam piping, which is reduced to 1¼ in. toward its end. The entire shop is fully piped overhead for both oxygen and acetylene supply, and regulator station drops are conveniently located along the walls or at columns.

Acetylene is delivered to the premises in cylinders, which are arranged in two single-row six-cylinder manifolds. The main acetylene supply line is of 1¼ in. diam, reducing to 1 in. diam at the line end. Each six-cylinder manifold provides a maximum capacity of 300 cu ft per hr. A pressure of 12 psi is maintained.

Better than 6,000 tons of steel plate now pass through the cutting and welding departments annually, which figure indicates the rapid turnover developed in this comparatively small plant (only 25,000 sq ft of floor space). Out of a total of 80 men, working three shifts, 21 are cutters, seven on each shift. An eight-hour day, six-day week schedule is maintained.

Fig. 9—Stack flame-cutting, using a drawing template and manual tracer. Ten ¼ in. plates, 19 in. wide and 24 in. long, are clamped tightly together and welded along the ends with transverse sealing beads. The shapes are then cut as a solid and when completed are loosened into the duplicate units at right. These parts are for a small pump base.

SCIAKY

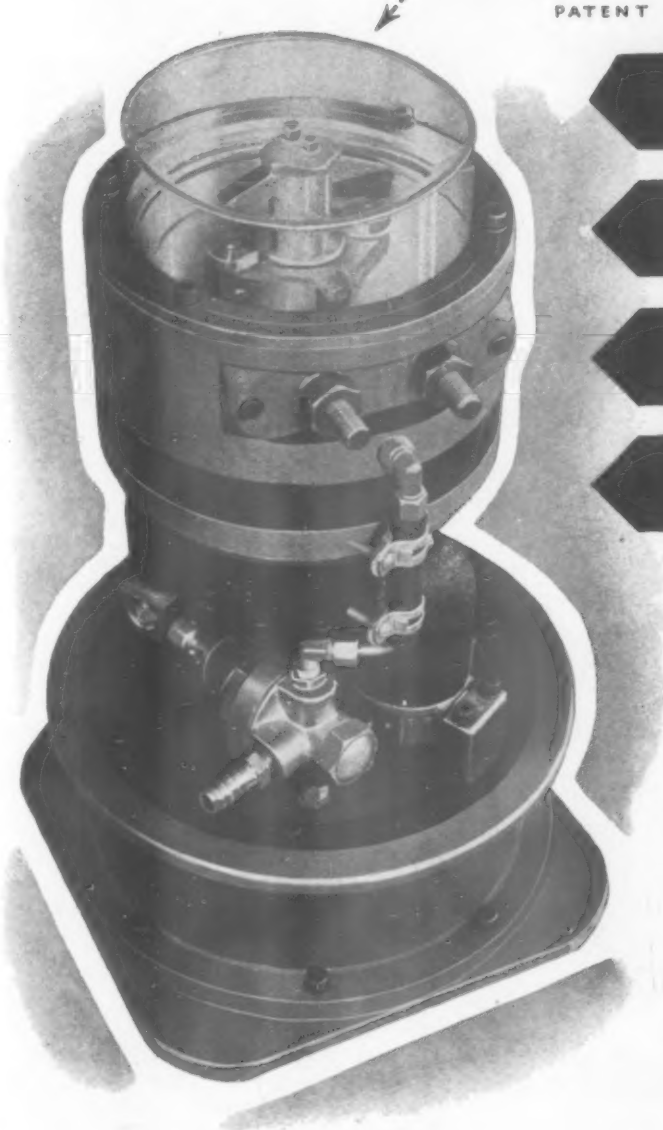


announces a significant achievement in the field of electro-magnetic stored energy resistance welding . . .

a d-c current interruptor — *without arc*

DYNATROL

PATENT PENDING



NO ROUTINE MAINTENANCE REQUIRED

ACCURATE CONTROL OF SECONDARY CIRCUIT DUE TO ABSENCE OF ARCING IN PRIMARY

INCREASED EFFICIENCY OF ELECTRO-MAGNETIC ENERGY SYSTEM — SHORTER CHARGING TIME

SPEED INCREASED 20% OVER MACHINES OPERATING ON CONTACTOR SYSTEM

THE SCIAKY DYNATROL provides the answer to contactor problems on electro-magnetic stored energy resistance welding equipment. This high-speed device performs the function of accurately interrupting the charging current to the reactor *without arc*.

The problem of interrupting a d.c. current in a highly reactive circuit has always been considered difficult because it is necessary to dissipate the electro-magnetic energy stored in the circuit in order to stop the flow of current. On former Sciaky machines, this was accomplished by a contactor unit, which together with an arc-blowing device, arc-laminating shields, etc., produced a highly accurate interruption of the charging current.

However, in industrial production, the continuous arcing finally results in a deterioration of the contact tips, requiring periodical maintenance and replacement. It was considered desirable to solve this problem in such a way that the same consistent welds be produced without any maintenance of the interrupting device. To this end, the DYNATROL was developed and was found to be not only a means of more accurate and efficient current interruption, but also, because of the shorter charging time, *actually increases operating speeds 20%*.

The DYNATROL is available on all Sciaky Stored Energy machines up to 50KW.

Descriptive bulletin 201-A ready soon. Write for your copy.

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Manufacturers of a Complete Line of A.C. and D.C. Electric Resistance Welding Machines

4915 W. 67th Street, Chicago, 38, Illinois

On the Job

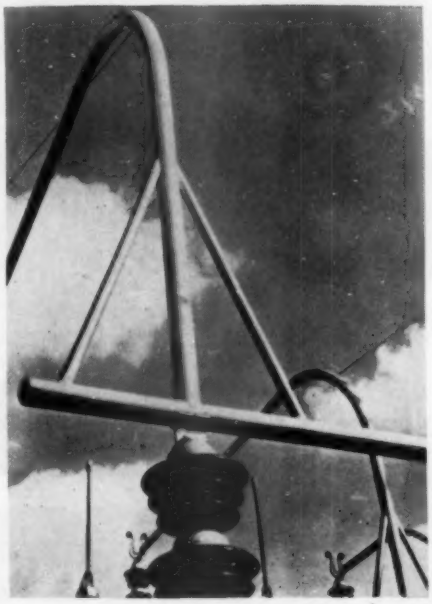
Wrought Iron Buses

WROUGHT IRON has proved itself a capable substitute for war-scarce copper and aluminum electrical buses, according to engineers of the Bonneville Power Administration in the state of Washington. Nor need this oldtime metal—known longer to man than any in the ferrous group—be classified solely as an ersatz material for buses; there are many points in favor of using it for permanent current-carrying mains.

J. A. Gerber, assistant engineer at Bonneville, stresses the following advantages of wrought iron electrical buses:

1. At 115 kv and 230 kv, the buses are found to be well within the carrying capacity of wrought iron pipe; the largest size required was 4 in. IPS, standard weight. Current-carrying capacity may be further increased, if necessary, by slotting the pipe along its length to break the ferrous loop and by coating the pipe with a dull black paint to increase the heat emissivity.
2. Welding is an easy, quick and economical way of joining the pipe into whatever bus arrangement is desired. All clamp-type fittings are eliminated. Welded joints have high electrical efficiency as well as permanence.
3. Welded buses reduce corona formation.
4. Wrought iron has a high modulus of elasticity, permitting long spans and particularly with ice and wind loading. Thus insulators, fittings and supports are saved.
5. It has good corrosion-resisting properties. Paint gives it additional protection and is easy to apply.
6. It expands less than copper or aluminum, thus reducing the number of expansion joints required.
7. It costs less than aluminum or copper pipe of the same size.

The welded wrought iron buses at Bonneville were finished by removing the protective asphalt varnish from the pipe, cleaning it with an abrasive and then applying one coat of synthetic red lead and two coats of aluminum paint.



Courtesy, A. M. Byers Co.

First recorded installation of wrought iron electrical buses is announced by engineers of the Bonneville Power Administration. The joints are welded. This picture shows details of the bus connection, which consists of a fixed support, Y-brace, corona-end-bell and bend. The pipe being used is 4 in. IPS.

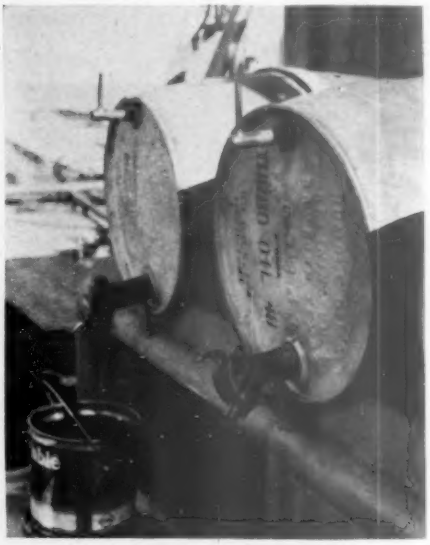
Official U. S. Marine Corps Photo

Marines can weld as well as they can fight. Somewhere in the South Pacific, a master of the welding torch, Private First Class Tony Costa (left), works on an important job with his helper, Private First Class Charles Morrow. Before joining their regiment of Marine engineers, Costa lived at New Bedford, Mass., and Morrow at Mansfield, O.

Oil Regulating Vents

By *Charles C. Lynde*

IT IS difficult to regulate the flow of oil from drums by gradually opening the plug (with the spigot wide open) because the air entering the drum will cause an erratic flow. A device to insure an even flow of oil at a rate permitting valve closure before the transfer container overruns was designed by the weldor for a large trucking company.



Welded vent (top) designed to admit air into oil drums and thus insure an even flow of oil through the spigot.

In place of the customary ¾ in. plug, a ¾ in. pipe nipple, 6 in. long and threaded at only one end, was used. The blank end was welded so as to form a bull nose plug. Near the closed end, a 4 in. nipple of ⅛ in. pipe was welded at right angles to the larger nipple.

This vent is screwed into the small opening in the drum end at the same time that the spigot is inserted and the drum laid on its side. Extending above the level of oil, even in a full drum, the ⅛ in. nipple admits the air in sufficient quantity to give a uniform flow through the spigot. The small nipple also acts as an expansion valve, permitting the escape of air when the pressure within the drum is increased under heat of the sun.

MORE MAN HOURS THROUGH *Extra* Safety

☆ ***All Meco Safe-T-Chek Regulators*** are equipped with the special patented Safe-T-Chek bleeder valve.

This valve, located in the high-pressure inlet, holds back the flow of oxygen until both seat and diaphragm can come into operating positions and controls the flow of oxygen in case of emergency—worn, or burning-out seats—or diaphragm failure.

This extra safety factor, found only in Meco Safe-T-Chek Regulators, thus protects against production delay—protects against regulator failure—and protects against the factors of human accident when regulators cease to function properly.

Enjoy all these Extra safety factors by specifying Meco Safe-T-Chek Regulators.

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WELDING AND CUTTING EQUIPMENT

MODERN ENGINEERING CO.

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TO
Speed Deliveries
OF
VITRIFIED WHEELS

Vitrified Bonded Wheels are very much in the Cortland production picture — and the Circular Continuous Tunnel Kiln shown here is a step toward better delivery on this type of grinding wheel, in sizes of 16″ and smaller. You can depend upon Cortland for quality — and for better deliveries than ever before when you want them.

* * *

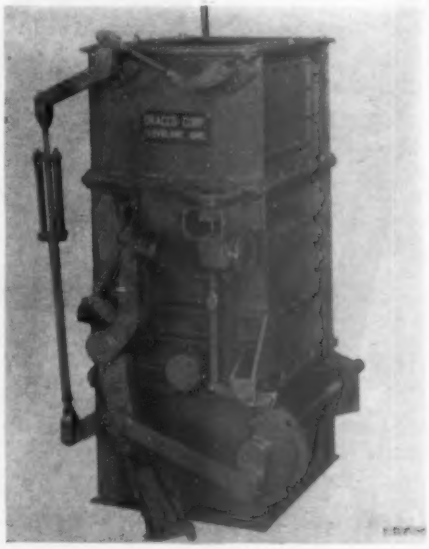
Resinoid Bonded Wheels in all standard sizes for weld grinding are available for the usual prompt shipment.

CORTLAND GRINDING WHEELS CORP.
15 CORTLAND STREET, CHESTER, MASS.

CORTLAND
GRINDING WHEELS

Welded Gate Lock

AN EXAMPLE of redesign for welded fabrication that afforded substantial savings in construction costs is a gate discharge lock for a pneumatic conveyor system built by the Dracco Corp. of Cleveland. The former unit was made of cast iron ½ in.



Courtesy, The Lincoln Electric Co.

Welded discharge lock for pneumatic conveyor.

thick; although it served its purpose efficiently, it was heavy, bulky and of cumbersome appearance.

A similar gate lock is now produced at a savings of 30% over the old method. This is constructed of ½ and ¼ in. mild steel plate, welded with 3/16 in. mild steel electrodes. The new gate lock has the same capacity as the old structure, weighs considerably less and is said to be even more reliable in operation.

» «

Cutting Track Extension

HERMAN JOHANSON, shipyard worker, was one of seven employees of the Permanente Metals Corporation's Richmond Shipyard No. 1 to receive honorable mention in recognition of suggestions submitted to the War Production Drive. Johanson's idea was a device to save time in flame-cutting bevels in shell frames.

This work is done by running a cutting machine along the beam with the torch set at an angle to produce the proper bevel cut. Since the machine precedes the torch, there still remains a foot or more of cut to be made when the end of the beam has been reached. Formerly, it was necessary to turn the machine end for end and reset the torch at the proper angle in order to finish the cut. This operation used to take about five minutes on each beam.

Johanson eliminated the "turn-around" by designing an extension platform of sheet metal which slides into engagement with the unfinished end of the beam and is flush with the surface along which the machine is traveling. The cutting machine is thus enabled to travel beyond the end of the beam, permitting the torch to finish the cut.

PAGE *Welding* ELECTRODES

Then you know how important it is that the metal deposited in the weld shall equal the Stainless you are welding. PAGE took away all uncertainty in that regard when they, in cooperation with the largest manufacturers of Stainless Steel, produced a complete range of PAGE-ALLEGHENY STAINLESS STEEL ELECTRODES—a range so complete that from it you can select the exact electrode for your work.

* * *

Because Stainless Steel stands so high on the list of critical materials, it is more than ever necessary to see to it that the electrode you are able to get will give you the proper metal in the weld. And it becomes even more essential to see that you get electrodes of the proper diameter and that your men waste none of them.

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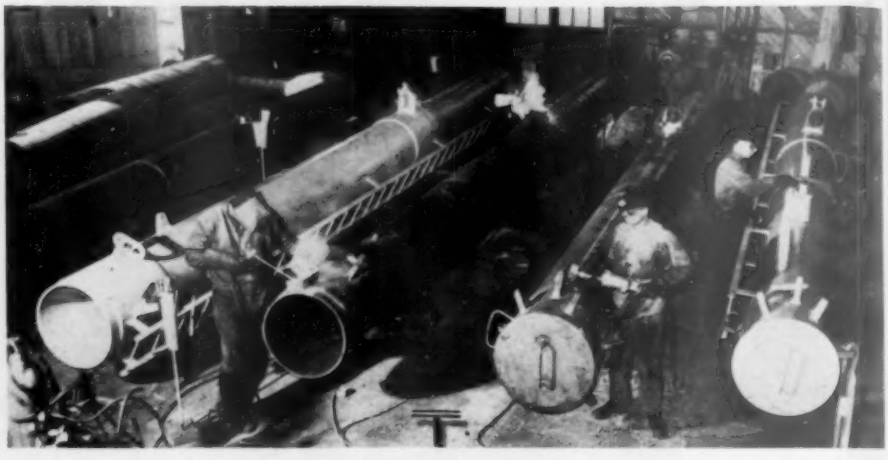
ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, **AMERICAN CABLE** Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

Welding King Posts

THE Weber Showcase & Fixture Co. of Los Angeles encountered not a few problems when it converted its entire plant from peacetime products to the production of funnels (see page 72, THE WELDING ENGINEER, October, 1943) and king posts for Liberty ships. The king posts are rolled and welded from 5/8 in. steel plate. Each is 30 ft long and is welded in three sections. An extra band of 1/2 in. plate is used to reinforce the area where the boom steps are attached.

To put the manufacture of these posts on a production basis, the company constructed automatic rotating devices. The posts are turned while the seams are being welded and also during the welding of the ladder and fittings. Large capacity arc welders, rated at 400 amp, are used.



Photo, courtesy of The Hobart Brothers Co.

Automatic rotating fixtures speed up the welding of king posts for Liberty ships. Note that the grinder (on third post from left) is able to work while welding is in progress.

The accompanying picture shows four king posts in different stages of production. The first post (left to right) has just had the ladder and fittings welded on. The second post is resting on the rotating device while the weldors add the fittings. The third post is being welded at the seams while another worker (foreground) grinds a seam to prepare it for painting. The fourth post is receiving a coat of protective paint.

A completed king post weighs 5,800 lb, including the 88 lb of welding electrodes consumed in its fabrication.

» «

Heart of a Fighting Ship

FASTENED to a tilted table on the production line at the East Pittsburgh works of the Westinghouse Electric and Mfg. Co., the steel "sunflower" shown below is being fashioned into a rotor for the electric drive on a Navy ship. Tilting the rotor speeds up welding by permitting the weldor to work in the flat position on all joints. After welding, the steel wheel will be studded with coils of copper wire and assembled in the frame.

Welding a rotor for a marine electric drive.

THIS IS IT!

— CHEK-SHOCK Oxygen CUSHION Valve —

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as, NOT necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents).* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY ONE MOVING PART, POSITIVELY FOOLPROOF

PRICE IS LESS THAN ONE REPAIR BILL

Universal coupler type (will fit any oxygen regulator) . . . . . $6.00 each
Screw-in type (for removable inlet stem regulators only) . . . . $5.00 each

— OPENINGS FOR DEALERSHIPS —

Send orders with M. R. O. to

Safety Shock Manufacturing Co.
FOWLER, CALIFORNIA

WELLS "Suregrip" ROD SAVER
(ELECTRODE HOLDER)

Using a Wells "Suregrip" Rod Saver is like finding money. In addition to saving you 7 to 14% on rod costs the Rod Saver also averages 50% less on upkeep costs than ordinary, insulated rod holders.

These are startling statements. They can only be made because they are established facts.

Other Wells "Suregrip" features you should know about are: the quick rod change, taking only a twist-of-the-wrist, the tremendous grip it exerts on the electrode (up to 1000 lbs. per sq. inch), the air-conditioned handle that reduces surface contact with the glove by 50%. Ideal for use in close quarters—overall length only 10½". All metal parts get full protection from tough, durable insulators. Place anywhere without arcing danger. REMEMBER: the Wells "Suregrip" lets rods burn 1¼" stubs—there's your 7 to 14% saving. Ask your dealer or write direct.

Martin Wells
Manufacturer

886 COMPTON AVE. LOS ANGELES 1, CALIF.

Amsco 217 Hard-Facing Added 380% to Life of Lister Shares . . .

The shares or lathes of a lister (a combination plow and planter) get a lot of severe wear, notably in the sandy soil around Clarks, Nebraska, whence comes this report from a welding shop, sent to a distributor of Amsco Conservation Welding Products:

"We are sending you two worn-out lister lathes that have been hard-faced with Amsco No. 217 rod. These lathes have plowed over 600 acres in sandy soil for a local farmer, in which the same shares without hard-facing have plowed only 125 acres."

Since hard-facing these lister shares, shown in picture R-898, made it possible to plow 475 additional acres, this hard-surfacing application gave a 380% increase in service life over shares which were not hard-surfaced.

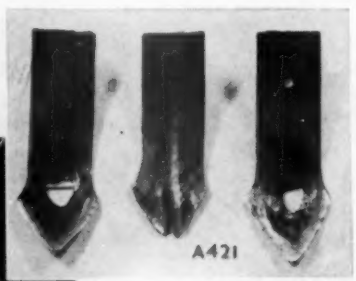
Picture A-421 shows, right and left, two cultivator shovels also hard-faced with Amsco 217 by the same welder, which tilled 500 acres of the same sandy soil. The center shovel, used as it was bought, had to be removed from service after plowing only a little over 100 acres. On this job, hard-facing paid a performance dividend of 400%.

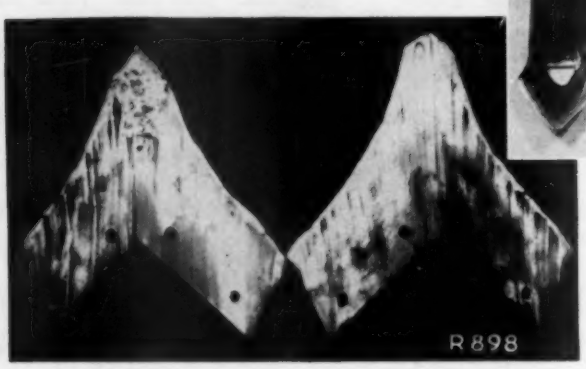
The importance of such hard-surfacing applications is emphasized by the current scarcity of farm equipment and replacement parts.

Numerous factory and field equipment parts exposed to severe abrasion should be hard-surfaced to insure the longest possible service life and fewest interruptions of service, as well as the conservation of parts which may be difficult to procure.

Amsco No. 217, a cast chromium-molybdenum-tungsten alloy rod, makes sound deposits with a Brinell hardness of 600-700, which are extremely resistant to abrasive wear.

There's an Amsco Hard-Surfacing Welding Electrode or Rod for every requirement. They include: Amsco No. 459, No. 217, Economy Hardface and Amsco Farmface.





Write for Bulletin 941-W on Amsco Welding Products.

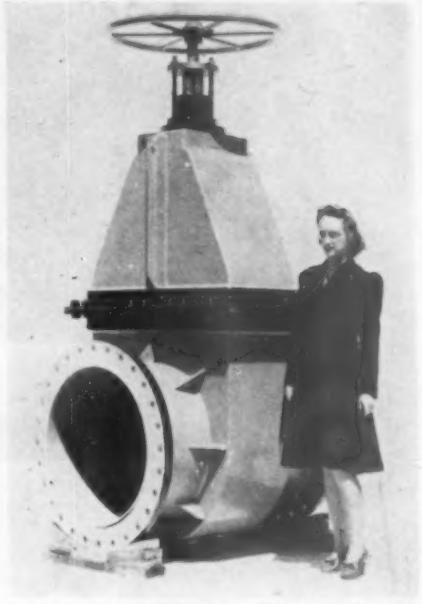
Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL., NEW CASTLE, DEL., DENVER, COLO., OAKLAND, CALIF., LOS ANGELES, CALIF., ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN Brake Shoe COMPANY

Giant Gate Valve

By *John H. Hinkle*
Fraser-Brace Engineering Co.

DUE TO CHANGES in operating requirements at the Keystone Ordnance Works, Geneva. Pa., a 30 in. gate valve was required promptly to permit completion of the construction work. Such a valve, however, could not be delivered from the usual sources of supply in less than ten months.



Courtesy, The Hobart Brothers Co.

This 30 in. gate valve was fabricated "on the job" by welding. As shown by comparison with Miss Frances Lysle, the valve is 9 ft 6 in. high.

Since it was impossible to permit the construction work to be delayed that long, the Fraser-Brace Engineering Co., designer and contractor for the ordnance plant, ordered its construction in the welding and machine shop on the project.

The valve was designed in such a manner that it was practicable to build with the limited equipment available. It was constructed by the steam-fitters in the pipe shop entirely of stock materials, a great portion of which could be classified as scrap.

First, a section of 30 in. pipe was cut at the proper angle to form the wedge; the ends of the same piece of pipe were used to form a base for the seats and flanges. Steel plates were cut to form the sides of the wedge, and faces were formed by building up the plates with bronze welding rod and then machining the deposits.

The plates were arc welded to the wedge section of the 30 in. pipe in order to form the complete gate. A steel block, made up of arc-welded plates, was welded to the top of the gate to form the base for the bronze adjusting nut. This nut was also built up by arc welding, using brazing electrodes. The seats were formed of steel plate with faces built up of brazing rod and machined smooth.

When completed, this valve stood 9 ft 6 in. high and weighed around 5,000 lb. It was constructed in three weeks' time at a cost approximately that of a factory-made valve of equal size.

We'll be serving you — All ways!

And literally, this quartet will do just that! The four P&H Harstain electrodes are ready to answer your every need in welding all analyses of stainless as well as for many special purposes on other steels.

They'll do *their* part. You can count on them! But won't you do *your* part too? Remember, stainless is critical. It can't be wasted. Use up your Harstain completely. Save the stubs for stainless scrap. And be sure always that you select the *right* electrode for the specific job.

P&H engineers or representatives will gladly advise you regarding their proper use. Information on the complete line of P&H Alloy Electrodes will be sent on request.

P&H Alloy ELECTRODES

P&H Builds a Complete Line of A.C. and D.C. Arc Welders. If your need for welding equipment is urgent, immediate deliveries can be made on proper priority. See your nearest P&H representative; write or wire us. Literature on request.

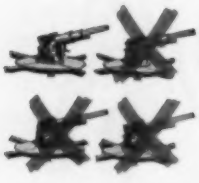
Gen. Offices and Factory: 4513 W. National Ave., Milwaukee

HARNISCHFEGER
CORPORATION
WELDING ELECTRODES · MOTORS · HOISTS P&H ELECTRIC CRANES · ARC WELDERS · EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Company, Ltd.

...with **X-RAY**

...the modern way to "know" what you're getting



A New England war plant, purchasing steel castings from an outside source, was experiencing a reject rate of 75% *after* machining. Each reject meant a loss of 3 machine and man-hours. Solution: X-ray inspection to "spot" defective castings *before* machining. Result: 100% real production from same men and machines . . . tremendous savings in materials. Another example of how Westinghouse X-ray takes the "guesswork" out of industrial inspection . . . speeds production and cuts costs.

J-02022

More Information? *See page 69*

Westinghouse
X-RAY
PLANTS IN 25 CITIES...OFFICES EVERYWHERE

Photo, courtesy of General Electric Co.

Arc blow was excessively troublesome on this job because of the magnetic disturbances created inside each cell of this giant steel honeycomb. The trouble was eliminated by switching to A-C welding.

Weld Big Gratings

THE STEEL gratings welded at the Melrose Park plant of the Mississippi Valley Structural Steel Co. provide a striking example of the truism that there is nearly always a way to do it if you will only look long enough.

These enormous gratings were fabricated of ¾ in. by 8 in. mild steel plate. Two gratings were first mounted on a 12 ft, 20 ton positioning fixture in order that each joint might be brought into the flat position.

The first attempt to weld the gratings was made with D-C arc welders and E-6020 class horizontal fillet electrodes. Despite the use of the positioning fixture and electrodes especially designed for fillet welding, the final results were not acceptable. Yet the weldors who did the work were all experienced and competent operators. Something was wrong, certainly, but what?

An analysis of the situation showed that magnetic disturbance to the arc was especially troublesome on this particular job because of the fact that the weld beads had to be deposited on the inside of the cell-shaped openings. Consequently, undercutting was excessive, and it was almost impossible for even the most skillful operator to deposit weld metal where it belonged. The welding current was reduced, but this produced no appreciable change except a reduction in welding speed. Arc blow was just as much of a nuisance at low current.

A 500 amp, transformer-type A-C welder was then put on the job. An immediate improvement was noted. The arc was no longer disturbed by magnetism, even when the current was increased for faster welding, and the operator was able to deposit the weld metal for the full length of the joint without undercutting.

Both A-C welding and D-C welding have their place in metal fabrication, and neither method should be thought of as one that is going to supplant the other. They should be looked upon not as competitors but as partners—each one with special capabilities for certain particular jobs.

"GENERAL" WELDING FUME EXHAUSTERS

For effective elimination of the *Noxious Fumes* from

Arc Welding
Galvanized Iron Soldering
Spray Painting, Etc.

TWO TO TEN INLETS—

For multiple hose connections in shop and field operations.

SINGLE INLET UNITS—

For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

SEMI-PORTABLES—

Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

PORTABLE "JUNIORS"—

40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

Bulletin CB-103 gives specifications and dimensions for the 28 types and sizes comprising the "General" line.

GENERAL BLOWER CO.

403 N. Peoria St., MONroe 0244
New York CHICAGO 22, ILL. Detroit
Pittsburgh Philadelphia Cleveland

WELDING RODS TENSOX

Meet U.S. Army Air Corps. Specifications 10286-B-2G

Tensox is an all position gas welding rod. Recommended for high strength welding of:

Steel Plates • Sheets
Structural Shapes
Pipe Lines • Steel Castings

Central Steel & Wire Company

OFFICES AND PLANTS

CHICAGO, 80, ILL. 3000 W. 51 st. St. • REPUBLIC 3000
DETROIT, 11, MICH. 5035 Bellevue Ave. • PLAZA 6780
CINCINNATI, 16, OHIO 525 Township Ave. • AVON 2230
DAYTON, 1, OHIO 1095 E. Monument Ave. • FULTON 8181

TELETYPE NUMBERS:- CHGO 1269 · · DET 33 · · CIN 64 · · DAY 146

The Technical Slant

Books are the ever-burning lamps of accumulated wisdom—*G. W. Curtis.*

The Welding Encyclopedia

THE WELDING ENCYCLOPEDIA, 11TH EDITION. *Edited by L. B. Mackenzie and others, re-edited by T. B. Jefferson. Published by The Welding Engineer Publishing Company, Chicago, 1943. Simulated leather, 6 x 9 inches, 976 pages. Price $6.*

The issuance of the 11th edition of *The Welding Encyclopedia* signifies an important achievement for the welding industry. This encyclopedia of welding was originally published in 1921 and has gone through successive editions biennially until now more than 150,000 copies have been distributed throughout the United States and in all parts of the world. Libraries, trade schools and authorities generally recognize it as one of the most useful standard reference books on welding and welding shop practices.

The 11th Edition should prove to be the most valuable one of all, for *The Welding Encyclopedia* has kept pace with the gigantic strides made by welding during the past two years. The information regarding metallurgy, electricity and the various welding processes has been greatly expanded as have been the discussions dealing with the various welding applications such as shipbuilding and aircraft work.

It was the aim of the editor to present a thorough, detailed treatment of every subject which relates in any way to welding, and in the process of accomplishing this objective it was found necessary to increase the size of the book by 260 pages over the previous Edition. This 260 pages represents all-new material.

Not only has the information presented been extensively enlarged, but the contents have been rewritten and rearranged, too. As in a dictionary, the subjects are arranged alphabetically. Editorial cross-references will be found frequently to facilitate the thorough covering of a subject, and there is, furthermore, a complete general index, a new feature included for the first time in this edition. This index will undoubtedly add greatly to the convenience of reference.

The 976-page volume is, in reality, in five parts. The first part, a concise encyclopedia of welding, is followed by an appendix which presents many interesting tables, charts, specifications, temperature conversion tables, examples of good and bad welding and an elaborate comparison chart of various welding electrode trade names and comparable AWS designations. Part three is a dictionary of trade names, listing all of the trade names applying to the welding industry. This is followed by a Buyers' Manual, after which comes the ten-page general index.

The defining characteristic of this great reference encyclopedia is its practicability. The alterations and additions included were in many instances suggested by criticisms and inquiries for information from students, weldors, supervisors and engineers. The reader may, therefore, expect to find quickly almost anything he desires to know about welding and its related processes.

» «

Welding Design

STUDY IN ARC WELDING—DESIGN AND CONSTRUCTION. *Published by the James F. Lincoln Arc Welding Foundation, Cleveland, 1943. Simulated leather, 6 x 9 in., 1296 pages. Price $1.50 in United States, $2.00 elsewhere.*

"Studies in Arc Welding" is a combination of 98 of the outstanding papers submitted by contestants in the 1940-42 industrial progress program award conducted by the James F. Lincoln Arc Welding Foundation. The volume is the result of careful editing of papers on arc welding, representing the work of 113 engineers, designers and other technicians, each of whom applied himself individually to a specific design study involving arc welding.

Many of the studies involve plants now engaged in war production, but the principles and practices reported in individual studies are also applied to industrial design and manufacture in the postwar era ahead. Each study includes designs, calculations, procedure and other pertinent information showing how the advantages attributed to arc welding are obtained. Many of the illustrations included are actual photographs of welding procedure.

These studies also point out the economies of modern arc welding. As is clearly evidenced, hundreds of millions of dollars could be saved by adopting arc welding in the design and manufacture of many steel products. There is also provided information that will be of considerable value to engineering, technical and trade schools interested in authentic data on arc-welding design applications as well as welding data which may be translated into new applications.

The contents of the book are arranged in nine sections with 98 chapters. Each chapter covers a specific design subject, while each section covers a particular field.

» «

Maintenance Welding

MAINTENANCE ARC WELDING. *Published by James F. Lincoln Arc Welding Foundation, Cleveland, 1943. Simulated leather, 6 x 9 in., 233 pages. Price 50c in the United States, 75c elsewhere.*

"Maintenance Arc Welding" is the second book to be developed from the 1940-42 industrial progress award program conducted by the James F. Lincoln Arc Welding Foundation. It consists of 25 of the most significant award papers in the program's maintenance classification, and the information presented should be found particularly useful in keeping machinery and plants in operation despite the critical shortages in material and equipment. The papers deal with the use of arc welding in reclaiming broken and worn parts and give many details on the application of welding in fabrication of replacement parts. Many different fields of commerce and industry are covered.

The 25 chapters of this book cover such industrial plant maintenance problems as those of steel mills, saw mills, cement, chemicals, ceramic and gravel plants, furniture manufacture, foundries and farm machinery. To keep the interest sufficiently diversified, there are also maintenance discussions of mining, power plants, railroad and refinery equipment.

In general, "Maintenance Arc Welding" should prove to be a valuable guide and reference for one of the most common and useful fields to which arc welding is applied.

» «

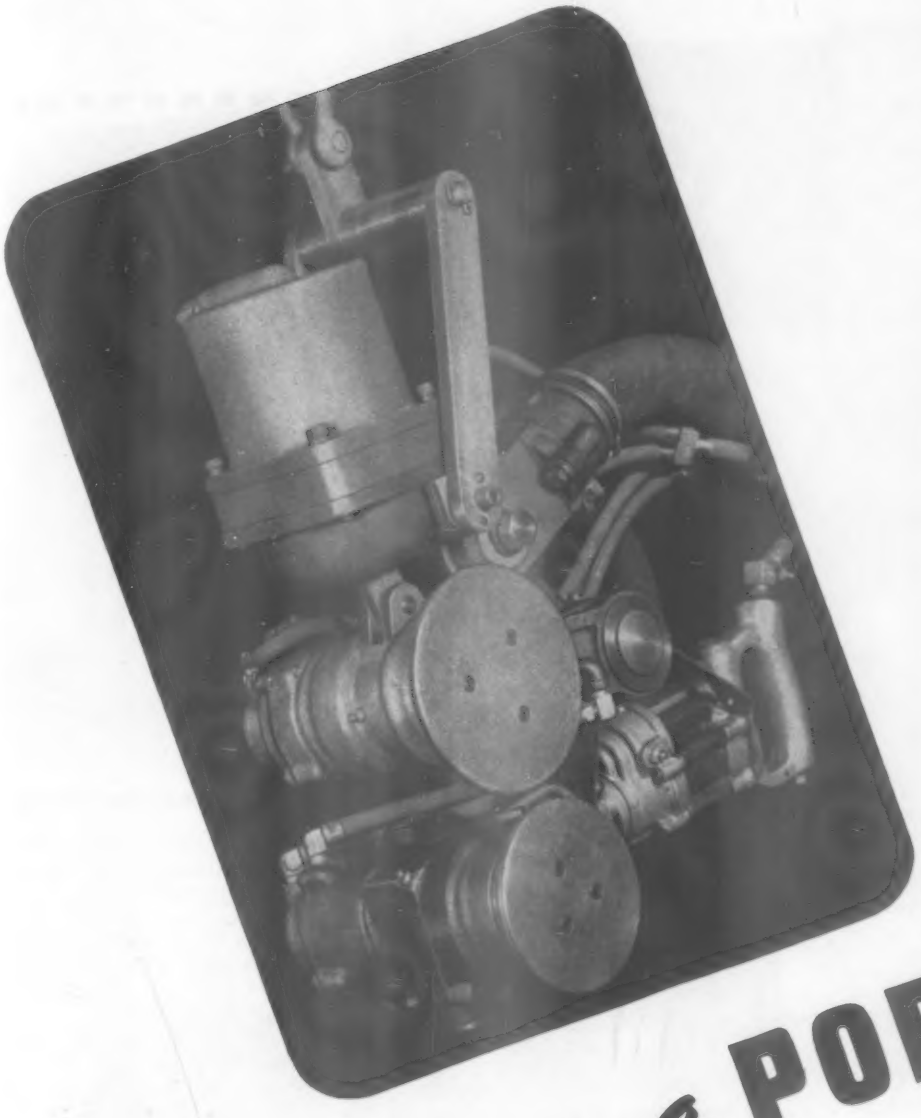
Maintenance

HOW TO MAINTAIN ELECTRIC EQUIPMENT IN INDUSTRY. *Published by General Electric Co., Schenectady, N. Y., 1943. Cloth, 8½ x 10 in., 372 pages. Price $1.75.*

In what is probably the most comprehensive book on electrical maintenance ever published will be found information intended to help industrial plants get the maximum performance and longest life from their electrical equipment. The material was prepared by men with years of practical field experience, and the volume speaks the language of the maintenance engineer throughout.

Of special interest to this industry is a 20-page chapter on "How to Maintain Welders". The discussion includes a-c, d-c and atomic-hydrogen arc welding equipment and automatic welding heads. Much of this chapter is devoted to preventive maintenance, and the importance of periodic inspection and maintenance is emphasized as a means of preventing major equipment failures. If trouble occurs, however, the reader is provided with a handy trouble-shooting chart which lists many possible troubles encountered in welding, their causes and how they may be cured.

In addition to the information regarding welders, other chapters cover battery trucks, bushings, cable and iron capacitors, furnaces, industrial controls, instruments, light switches and many other items of electrical equipment. Every attempt has been made to make the book both easy to read and a handy reference. Prominent marginal headings simplify the finding of the material desired and there is ample space provided for making marginal notes.



Announcing a PORTABLE Seam-Welder

Now you can take a seam-welder to the work instead of the work to the machine. Permits seam-welding of large parts. Originally designed and used for welding a 22 ft. coach-seam between two stampings of 20 gage hot-rolled. Maximum welding pressure of 1400 lbs. permits welding of stainless steel. Air-motor operated rolls; 3 inch throat depth; 100 KVA transformer with 750,000 cm. concentric kickless cable. Completely water-cooled.

For further details ask for Bulletin #802.

PROGRESSIVE WELDER CO.

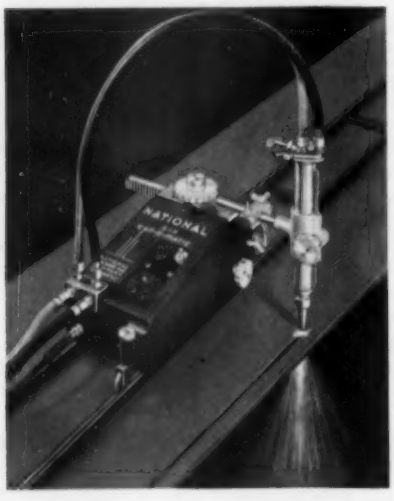
SEAM PRODUCTION & BUTT . . . *Electric Welding Equipment* . . . PORTABLE GUN & PEDESTAL

3050 E. OUTER DRIVE • DETROIT 12, U. S. A

New Products to Use

Portable Cutting Machine

★ The **"National Six Cut-O-Matic"** is a portable electric-driven oxy-acetylene cutting machine designed to fulfill the demand for a versatile flame-cutter which



"National Six"—a motor-driven flame-cutting machine for either straight, circle or irregular cutting on steel of various thicknesses.

can handle everything from light gauge steel to the heaviest sections. Many different types of cuts can be made with it: straight line, circle or arc and irregular; edges can be given a bevel or double bevel. The finished cut is said to be sharp-edged to a close tolerance. The machine is equipped with a 110 volt universal motor for both a-c and d-c operation; a voltage reducer can be furnished at a slight additional cost to permit operation on 220 v circuits.

A 12-page catalog, Form N-134, describing this machine is available from **National Cylinder Gas Co.**, 205 West Wacker Drive, Chicago.

» «

Hard-Facing Rod

★ Amsco **"Farmface"** hard-facing welding rod is a chromium-molybdenum rod especially developed to provide a tough protective coating on wearing parts of

Plow share which has been hard-faced with "Farmface" and is ready for long field service.

farm equipment. Its purpose is to retard the wear resulting from abrasion and from sharp blows (impact). Applications include plow shares, harrow teeth, lister shares, discs, corn husker teeth and other parts. **American Manganese Steel Div.** of the American Brake Shoe Co., Chicago Heights, Ill.

» «

Welding Spotlight

★ A new spotlight for arc-welding operators is announced by the Electric Welding Div. of the **General Electric**

G-E arc-welding spotlight. It permits careful observation of the work through the welding lens before the arc has been struck.

Co., Schenectady, N. Y. It is said to provide glareless illumination of sufficient intensity for a weldor to see his work distinctly through the dark lens of a welding helmet prior to striking of the arc. Use of this product (Cat. 89X391) is stated to be especially desirable for production-line welding in which the establishment of the arc must be made quickly and accurately, such as in the welding of thin materials, light alloy castings and aircraft parts. Time is saved since it is not necessary for the operator to lift his helmet before striking the arc, and spoilage is reduced because the arc can be struck precisely where required.

The spotlight, which consists of three 300 watt reflector spot lamps surrounded by a circular shade, is mounted on a telescoping metal standard set in an 18½ in. diam cast iron base. The lamps are mounted in porcelain holders adjustable so that the area covered by the beam can be increased from a single sharp spot 7 in. in diam to a clover-leaf pattern approximately 17 in. across. Light can also be raised or lowered on its standard. The unit is controlled by a foot-operated switch, which the weldor depresses while the arc is being struck.

Welding Positioner

★ P&H **Model WP-2** welding positioner has a capacity of 2,500 lb and is designed for production-line welding, job work, maintenance, etc. The 42 in. diam table

Model WP-2, new 2,500 lb P&H positioner.

has 18 radial slots for mounting fixtures. Table is turned manually to suit welding speed, but hydraulic power does the tilting, which may be varied up to 135 deg beyond the horizontal position. A telescopic column with self-locating stops provides for table elevation from 28 in. to 60 in. above the floor.

Available extra equipment includes electric power or ring gear and handwheel assembly for turning table with foot or push-button control, higher than standard columns and roller-equipped outboard supports for handling long or large weldments. Equipment for power table rotation at a constant speed of 1 rpm may also be had. **Harnischfeger Corp.**, 4513 W. National Ave., Milwaukee 14.

» «

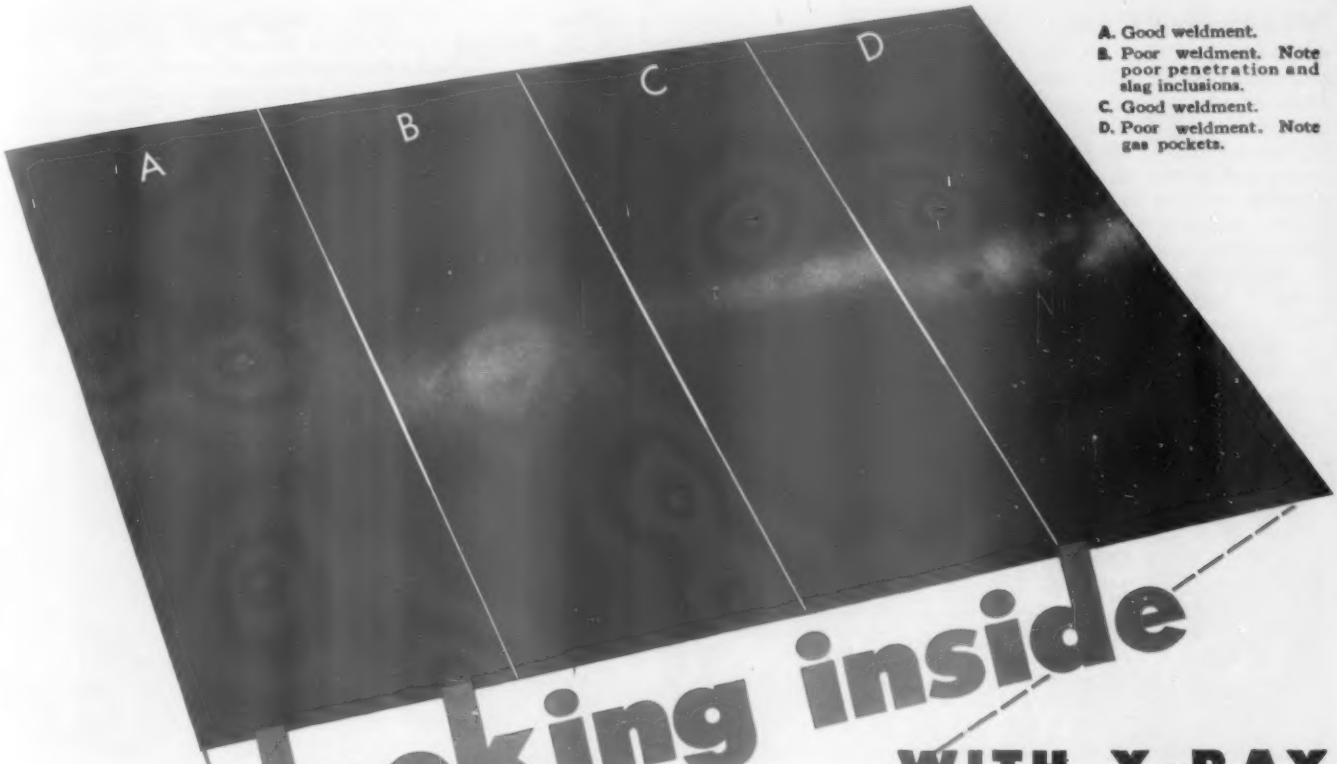
Cover Glass

★ Bullock **"Dalite"** cover glasses are of glass that has been processed with either a blue-tinted or clear protective coating designed to shield the glass against heat breakage and damage from metal spatter. This baked-on protective coating, manufacturer states, is proof against pitting, peeling and scratching. **Hopkins Engineering Co.**, 230 N. Michigan Ave., Chicago 1.

» «

Electric Tachometer

★ A self-energized tachometer, an instrument for measuring speeds up to 5,000 rpm, is announced by the **Ideal Commutator Dresser Co.**, 1935 Park Ave., Sycamore, Ill. Essentially, this device consists of a small generator coupled electrically to an electric meter. The units may be mounted together (hand type) or separated.



A. Good weldment.
B. Poor weldment. Note poor penetration and slag inclusions.
C. Good weldment.
D. Poor weldment. Note gas pockets.

looking inside WITH X-RAY

HELPS TRAINEES "CATCH ON" QUICKER!

They can SEE the difference between a good weld and a bad one

X-ray rules out guesswork in training, qualifying or classifying welders—or other workers—according to actual ability. It puts these all-important functions on a factual basis. For radiographs clarify . . . provide absolute proof . . . are readily understood because they *show* internal conditions that words fail to describe adequately.

They let the worker *look inside* the weldment, casting or assembly . . . show him whether it's good or bad . . . show him what to do and what to avoid. He "catches on" quicker, adheres to good, sound methods, and becomes a faster, more efficient producer from the start.

In addition to shortening training time and putting worker-classification on a factual basis, Westinghouse Industrial X-ray is doing countless other jobs faster, better and more economically. These fall into such major classifications as speeding production, saving machine and man-hours, conserving critical materials and improving quality.

For more information, write for Booklet B-3159. It suggests how and where you can benefit by using industrial x-ray. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-02025

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Industrial X-RAY

Self-Adjusting Clamp

★ **De-Sta-Co Clamp No. 470** is especially recommended for sheet metal and other work where the individual parts to be clamped vary in thickness on various locations of the same fixture group. A spring fitting onto one of the adjustment spindles provides for up to ⅜ in. variation in clamping thicknesses without readjustment; thus either ⅛ in. or up to ½ in. thicknesses, for example, may be clamped without readjusting the gap. Other features of this new clamp are a 3 in. throat width, improved swivel foot, a thumb screw adjustment and a copper plating over holding spindles and nuts to prevent damage from welding spatter. **The Detroit Stamping Co.**, 372 Midland Ave., Detroit 3.

» «

Goggle Lenses

★ **Noviweld-Didymium lenses** for gas welding are now produced in No. 3 shade —a lighter shade that is said to be particularly useful for weldors working on aluminum. The addition raises to four the number of shades in which Noviweld-Didymium goggle lenses are now available—Nos. 3, 4, 5 and 6. This glass protects eyes against both ultra-violet and infra-red radiation and also absorbs sodium flare. The lenses are said to preserve orange and red color values so that weldors can see the red-hot bead and the molten metal in brilliant colors. **American Optical Co.**, Southbridge, Mass.

» «

Resistance Welder Line

★ A complete line of resistance welding machines including spot, seam, butt and projection welders is now being offered by the **Larkin Lectro Products Co.**, 220 Taaffe Place, Brooklyn 5. These ma-

Foot-operated rocker-arm spot welder—a member of the new Larkin line of resistance welders.

chines vary from 1 to 75 kva capacity and have water-cooled tips, adjustable pressure pivot-type foot pedals, six or more heat stages and automatic trip switches. They may be equipped with precision timers and contactors, high power factor correction and air or motor drives at additional cost.

» «

Hard-Facing Rod

★ **"Kerk-Aloy"** is a hard-facing rod said to bond homogeneously with any metal except lead and aluminum and to exhibit unusual qualities of hardness, resistance to wear, thermal conductivity, low melting point and stability of temper. It can be applied with either oxy-acetylene torch or metal arc, does not require the use of bonding fluxes and is said to flow evenly without gasification. Applications include: harrow points, steam shovel lips, dredge lips, dippers, tappets, rocker arms, push rods, wrist pins, etc. **Kerk-Aloy Co.** Bloomington, Ind.

» «

Push-Button Units

★ A new line of push-button units for mounting on welding controls, machine tools and similar equipment has been announced by the Industrial Control Div. of **General Electric Co.**, Schenectady, N. Y. Available in both the pendent and the oilproof types, these units are made of hot-molded, moisture-resisting phenolic plastic. Both types may be obtained with buttons of various colors and with interchangeable labeled nameplates for easy identification.

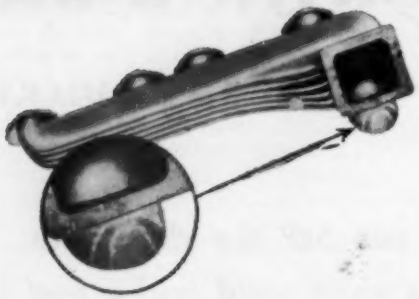
(Continued on page 75)

Castolin Eutectic

EUTECTIC*

(Means Lowest Binding Alloy)

LOW TEMPERATURE WELDING



NO GENERAL PREHEATING REQUIRED FOR WELDING CAST IRON

PROBLEM

How to repair this cast iron exhaust with a color matching, heat resistant weld? With high temperature, fusion welding there was great risk of stresses, new cracks, and distortion even in the hands of the most skillful welder. Bronze brazing could not be used since the job requires a perfect color match.

SOLUTION

Eutectic Low Temperature Welding Alloy No. 14 was tried. Its low binding temperature (950-1400°F) eliminated risk of stresses, new cracks, and distortion. Many jobs require only slight local preheat • Weld has high heat resistance • Easily machinable • Perfectly color matching.

EUTECTIC LOW TEMPERATURE WELDING ALLOY RODS FOR CAST IRON

Alloy No.	Purpose	Binds at °F.	Tensile Strength, Lbs. p.s.i.	Machinable
15	Filling cracks, defects	354° - 600°	1,140 (pressure)	Yes
14	High strength joining	950° - 1400°	48,000	Yes
16	Joining cast iron to steel	1300° - 1600°	117,000	Yes
248	Cast iron not subject to stresses		38,500	Yes
24	Cast iron subject to stresses		20-30,000	Yes

For oxy-acetylene: Eutectic Nos. 14, 15, 16. For AC-DC Metallic Arc: Eutectic Nos. 24, 248.

Chart of 43 Eutectic Alloys for every metal and every welding job available free upon request.

36 PAGE "KNOW-HOW" MANUAL K —WRITE TODAY!

Tells How Eutectic Can Help You!

*Reg. U. S. Pat. Off.

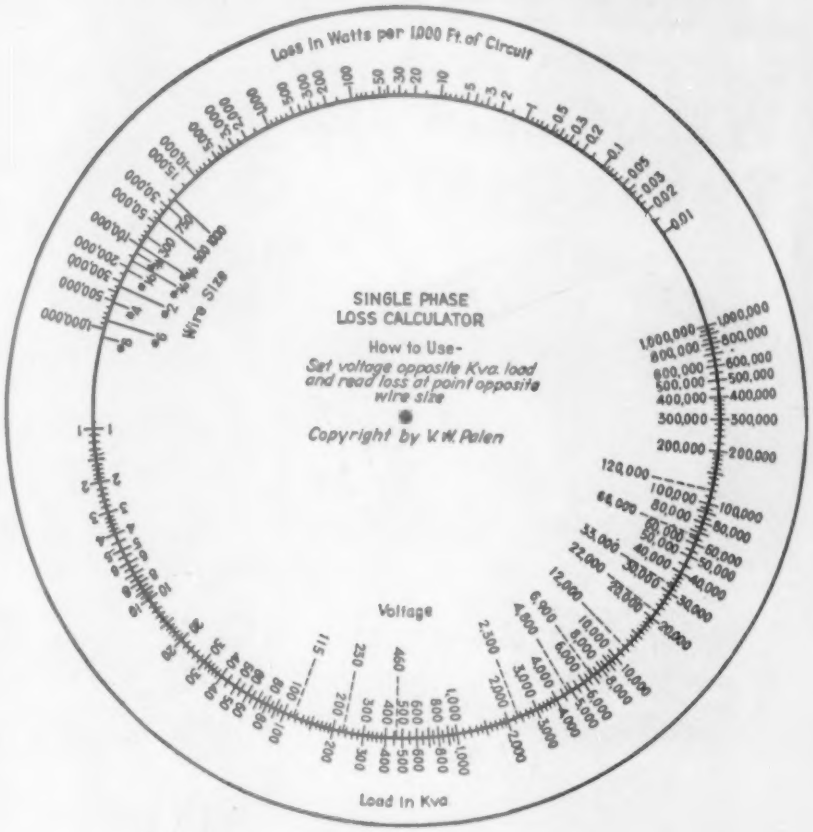
EUTECTIC WELDING ALLOYS COMPANY

Originators of the Low Temperature Welding Process

40 WORTH STREET, NEW YORK, 13, N.Y.

I^2R LOSS CALCULATOR

By **V. W. PALEN**
Westinghouse Electric and Mfg. Co.


Loss in Watts per 1000 Ft. of Circuit
SINGLE PHASE
LOSS CALCULATOR
How to Use-
Set voltage opposite Kva load and read loss at point opposite wire size
Copyright by V.W. Palen
Wire Size
Voltage
Load in Kva

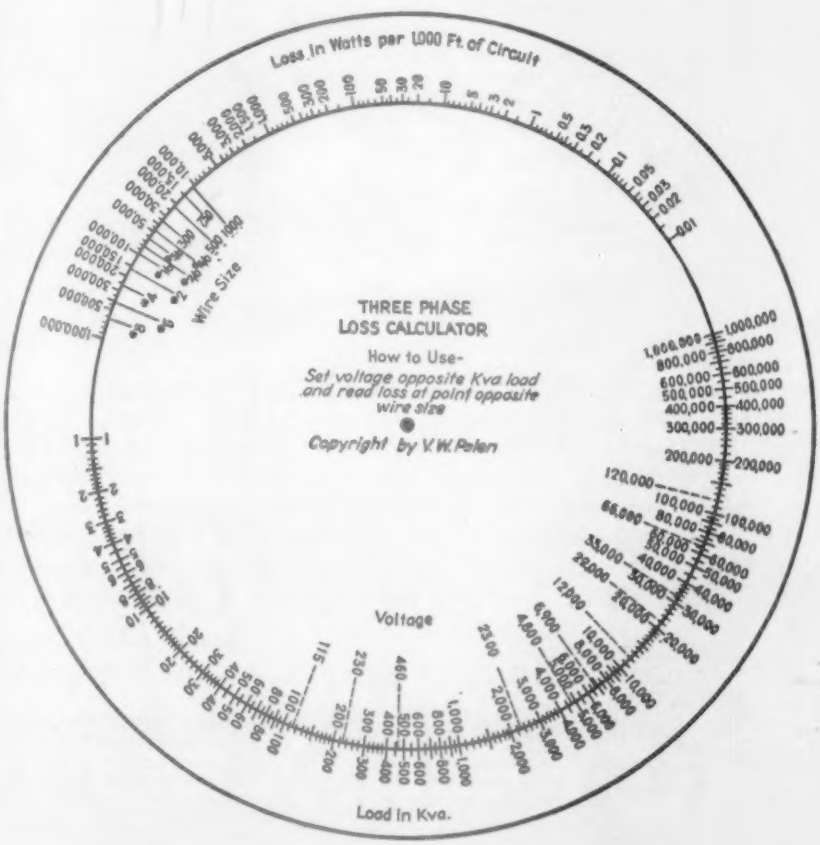
HERE'S a device which determines the I^2R loss in wire circuits with a flick of the finger.

Cut along the circles to make two discs and two rings. Using rubber cement (if available), mount the discs on separate pieces of cardboard. On reverse sides of a third piece of cardboard mount the two rings. Now punch the center holes and insert a small brass bolt to hold the discs in place. Washers will help to prevent wear and tear on the paper. Tighten the bolt to provide the proper pressure on the discs—they should hold their settings, yet turn easily. A drop of solder applied to the nut will make the assembly permanent.

The calculator solves the single phase equation:

$$\left[\frac{\text{Kva}}{\text{Kv}}\right]^2 \times 2R = W$$

Where R is resistance of 1,000 ft of single conductor and W is watts per 1,000 ft of circuit. The three phase equation handled by the device is equivalent to the single phase relationship divided by two. Copper conductor is, of course, the basis of design—stranded in sizes No. 2 and larger.


Loss in Watts per 1000 Ft. of Circuit
THREE PHASE
LOSS CALCULATOR
How to Use-
Set voltage opposite Kva load and read loss at point opposite wire size
Copyright by V.W. Palen
Wire Size
Voltage
Load in Kva.

Make Good Piping Better

with

WELDOLETS • THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

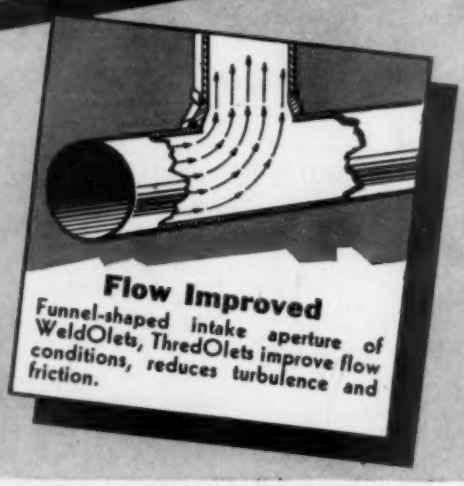
Socket-End WeldOlets for socket-type welded branch connections.

Save Weight

WeldOlets, ThredOlets keep the weight of any piping system to a minimum. Fewer flanged joints mean less possibility of leaks.

Gaskets, Bolts, Nuts

Maintenance eliminated when WeldOlets, ThredOlets are used—no need to change gaskets, tighten nuts and bolts.



Flow Improved

Funnel-shaped intake aperture of WeldOlets, ThredOlets improve flow conditions, reduces turbulence and friction.

Vibration

Due to light weight and improved flow conditions, vibrational stresses are reduced, possibility of leaks eliminated when WeldOlets, ThredOlets are used.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to pre-fabricated or "on-the-job" assemblies. Stocked for all standard pipe sizes up to 12" in size-to-size and reducing sizes—and can be supplied on special order for pipe up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan, Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for your copy today.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

ARMY E NAVY

Star Awarded July 10, 1943

WELDOLETS • THREDOLETS

TRADE MARKS REG. U. S. PAT. OFF.

Welded Outlets for Every Piping System

New Products to Use

(Continued from page 70)

Portable Testing Set

★ A newly designed 50,000 volt portable test set for use on single-phase, 115 or 230 volt, 50 or 60 cycle circuits has been announced by the **General Electric Co.**, Schenectady, N. Y. This set is intended

Portable 5 kva test set for testing electrical apparatus or insulating materials.

for application wherever high voltages up to 50,000 v are required for testing electrical apparatus or insulating materials. It combines in one truck-mounted unit an oil-insulated testing set, an indicating voltmeter, a voltmeter selector switch and complete control equipment such as air circuit breaker, line switch, foot switch and induction voltage regulator.

» «

Dust Collector

★ A portable self-contained dust collector of the cyclone-filter type for exhausting dust and dirt-laden air from the scene of abrasive operations is announced as the newest addition to the line of **"Dustkop"** dust collectors. It is recommended for collecting dust from production-grinding operations on big wheel surface grinders, medium size double-end grinders, discs, cut-offs, emery and belt sanders. **Aget-Detroit Co.**, 601 First National Bldg., Ann Arbor, Mich.

» «

Safety Goggles

★ The **"Stasafe Eyemask"** is a pair of goggles offered with either clear or green glass. Features are said to be: extra circulation of air allowed for unusually hot jobs, high impact resistance, light weight (2 oz), non-flammable construction. Both plain and perforated models are available. **Standard Safety Equipment Co.**, 232 West Ontario St., Chicago.

» «

Rotary Files

★ **Carbur, Inc.**, Lincoln Park 25, Mich. announces the addition of six new tools to its standard line of cemented carbide rotary files. These include three shapes, each furnished in two sizes. All of these tools have cutting teeth ground from the solid.

FLUXES to join All Metals

Chemists and Metallurgists
Since 1875

No matter how tough your welding, brazing or silver soldering job may be, there's a Fluxine Flux with which you can make perfect joints. Each Fluxine Flux is scientifically compounded for specific purposes . . . each is the proper flux for a certain job. Write a full explanation of your problem and Krembs will send a free sample of the right flux with instructions for use.

FLUXINE No. 43

For Silver Soldering and Gas Welding Stainless Steel, Inconel, Monel, Nickel and Nickel-Chrome alloys. Non-glaring. Used with low melting point silver solders. Meets Navy Spec. No. 51-F-4a; Air Corps Spec. No. 11316-A; Federal Ordnance Dept. Spec. No. AXS-500.

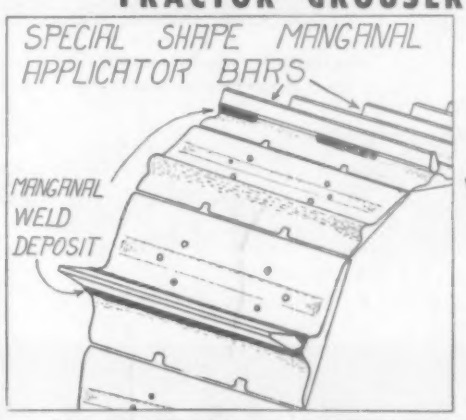
FLUXINE No. 18

For gas welding and atomic hydrogen welding Stainless Steel, Inconel and all Nickel-Chrome Alloys, etc. A Non-Poisoning and non-fuming flux. Scale chips off as work cools. Meets Navy Spec. No. 51-F-3a; Air Corps Spec. No. 11314.

KREMBS AND COMPANY 671 West Ohio St., Chicago 10, Ill.

TRADE MARK FLUXINE REG. U.S. PAT. OFF.
FLUXES TO JOIN ALL METALS

MANGANAL
(Reg. U. S. Pat. Office. U. S. Patents 1,876,738—1,947,167—2,021,945)
SPECIAL SHAPE
APPLICATOR BARS
FOR
TRACTOR GROUSER RE-TREADS



MADE IN FIVE SIZES EASILY WELDED TO ANY SHAPE OR SIZE GROUSER. PROVIDES A RE-TREAD FOR ALL TRACK LAYING TYPES OF EQUIPMENT.

Attach with Manganal Bars or Special Tite Kote welding electrodes.
Applicator bars are manganese nickel steel, the toughest metal known. Work hardens under impact and abrasion.
New parts are difficult to obtain. Saves approximately 80% of the metal of a new part, as well as time and money.

150 Distributors Are Ready to Serve You
Sole Producers
STULZ-SICKLES COMPANY
134-142 Lafayette St., Newark, N. J.
Try Seaco Hard Surfacing Over Manganese Weld Deposits

News of the Industry

Lincoln Electric Distributes Customary Incentive Payments

Saying that he refused "to renegotiate his own workers," President J. F. Lincoln of the Lincoln Electric Co., Cleveland, last month authorized the distribution of year-end "incentive payments" averaging over $2,250 per employee. The payments were computed on the same basis as that of the previous ten years in which the earnings of the man, combined with his years of service and his development, gauged the amount of money he received. The checks ranged from $25 for a newcomer to $50,000 to an engineer who had produced a new type of welder cutting the cost of production by nearly 50%. The distribution totaled approximately $3,000,000.

"Because of the incentive system, which has reduced the labor cost per piece by more than 50%, the Treasury Department has seen fit for the year 1941 to assess the company $1,600,000," commented Mr. Lincoln. "They state we paid our men too much, in spite of the fact that the pay per piece was less than any manufacturer making a comparable product."

The Treasury Department, according to Mr. Lincoln, has adopted the policy that "No man who works with his hands is worth $5,000 per year." This statement, he said, was made to him by Jesse F. Gregory, head of the Technical Staff of the local Treasury Department, and applied to men in the factory worker class.

Testifying on Dec. 2 before the Senate Finance Committee, Mr. Lincoln pleaded for the encouragement instead of the penalization of incentives for workers to increase production. "Because the methods pursued by manufacturers," he said, "do not correspond with bureaucracy's preconceived ideas of proper wages and their caste system into which they have placed labor, endless rules have been set up by this bureaucracy. These rules have successfully stopped contemplated production in many cases . . . costs are increased and production rate enormously reduced."

» «

Vocational Ass'n Discusses Postwar Weldor Training

The 37th annual convention of the American Vocational Association proved to be, in reality, a war work vocational conference. Among the numerous technical sessions which were held December 15 to 17 at the Palmer House and the Morrison Hotel, Chicago, was one devoted to the "Vocational Training of Welding Operators."

The program for the welding training session included three papers: "Welding in the World of Tomorrow" by T. B. Jefferson, editor of THE WELDING ENGINEER, "Vocational Training in Welding from the Point of View of a Chicago Industry" by H. A. Mattis, welding engineer, Pullman-Standard Car Mfg. Co., and "Welding Training in Public Vocational Schools—A Look Forward" by R. L. Welch, state supervisor of Trade and Industrial Education, Wisconsin. Howard K. Hogan, special representative, Vocational Training for War Production Workers, U. S. Office of Education, acted as chairman.

» «

Allis-Chalmers Sponsors Boston Symphony Program

On Christmas night the Allis-Chalmers Manufacturing Co., Milwaukee, assumed sponsorship of the Saturday evening broadcast concerts of the Boston Symphony on the Blue Network. The time of these broadcasts was shifted from 8:15 to 8:30 p.m., EWT.

HOW A $25.00 HARD-FACING JOB

Saved a $150.00 punch replacement!

TO HAVE REPLACED this badly worn hot upsetting punch with a new punch would have cost $150.00! It also would have necessitated an unavoidable delay in waiting until the new punch had been delivered and installed.

Again Coast Metals Hard-Facing saved the day! By building the worn punch up to its original dimensions with an extra wear-resistant coating of Coast Metals, it was made good as new. In fact, *better than new* since it will now outwear and outlast a new punch several times! All at a cost of only $25.00!

CLOSE-UP of Hot Upsetting Punch, Showing Coast Metals Overlay After Rough Grinding.

Instead of sending *your* worn parts to the scrap pile, see first whether you cannot salvage them through Coast Metals Hard-Facing. Easily applied by the electric welding arc or oxy-acetylene torch, it is equally suitable both for new and old parts of any ferrous metal.

COAST METALS, INC.

Plant and General Offices: Canton, Ohio • *Executive Offices:* New York, N.Y.

COAST METALS hard-facing weld rods

YOUR EQUIPMENT'S LIFE PRESERVER AGAINST WEAR

The three R's . . .

***R** is for Recruits* . . . new acetylene-welding trainees for America's huge industrial army.

***R** is for Reliable* . . . an assured source of acetylene, without delivery delays from bottlers.

***R** is for Reserve* . . . extra profits at each year's end, from acetylene economies up to 75%.

Sight Feed Acetylene Generators point the way to the three R's . . . why not apply their demonstrated advantages to YOUR business?

THE SIGHT FEED GENERATOR CO. • SALES: RICHMOND, IND. • FACTORY: W. ALEXANDRIA, OHIO

DALLETT
PNEUMATIC WELD-FLUX SCALING HAMMERS

Especially designed for roughing, peening, removing flux and excess metal resulting from welding operations.

- made in several sizes
- button or lever type throttle
- safety chisel retainer
- smooth in operation
- light in weight

write for Bulletin No. 500

THE DALLETT COMPANY

MASCHER AT LIPPINCOTT STREET — PHILADELPHIA 33, PENNSYLVANIA

PNEUMATIC AND HAND CHISELS ■ "DALBO" AIR HOSE COUPLINGS

"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS

■ ■ *"DALWELD" DETACHABLE WELDING CABLE CONNECTORS* ■ ■

Clevelander Wins $200 in Metallizing Contest

R. C. Overstreet, an employee of Tinnerman Products, Inc., Cleveland, was the recipient of the $200 first prize in the recent contest sponsored by Metallizing Engineering Co., Inc., to secure ideas on how metal-spraying equipment can be used to conserve critical metals. Mr. Overstreet described a faster, more durable way to protect speed nuts against corrosion.

L. W. Sagle, Baltimore & Ohio Railroad Co., Baltimore, won second prize of $100 for procedures showing how replacements are avoided and worn parts reclaimed. Other winners of prize money are:

J. S. Kernachan, United States Engineer Office, Buffalo; C. G. Holloway, Isaacson Iron Works, Seattle, Wash.; G. H. Wolfe, M & R Products, Inc., Kalamazoo, Mich.; C. Smith, International Telephone & Telegraph Corp., New York City; G. De Sylvester, General Electric Co., Schenectady; P. Ziegler, Zapfe Machine Shop, Kitchener, Ontario; C. P. Fessant, Motor Vessel *Kenozha*, Sarnia, Ontario; T. Horn, Crescent Operations, Anniston, Ala.

» «

Corp Bros., Providence, Marks 50th Anniversary

An attractively printed brochure of 16 pages was issued by Corp Brothers, welding supply distributors of Providence, R. I., to remind customers that the firm is this year celebrating its fiftieth year of doing business.

The original partnership of Corp Brothers was established by Henry and Frederic W. Corp in the summer of 1893 to do nickel plating and repair bicycles. Brazing was included among the bicycle repair work. When in the early 1900's the business changed over to an automobile repair business, the brazing forges which had brazed the joints of bicycle frames were used to braze cast auto parts by means of a brass spelter.

In 1909 the firm became the first job welding shop in Providence, doing what its advertising of that era referred to as "autogenous welding." In 1934 the assets and good-will of a firm engaged in the selling of welding equipment were purchased, and from that time on the welding supply business grew rapidly. Today the sole function of the firm is the distribution of welding equipment and supplies for both oxy-acetylene and arc welding.

» «

New WPB Rules Govern Galvanized Steel Products

Galvanized steel products in controlled material form are Class A products when sold by a galvanizer who is not a steel producer, the War Production Board recently announced. When sold by a steel producer, such products are controlled materials; when sold by a distributor, they are controlled materials regardless of who produced them.

To order galvanized steel products in controlled material form, warehouses must use Form WPB-2444 (formerly CMP-11), regardless of whether the order is placed with a steel producer or with a galvanizer who is not also a steel producer.

» «

Postwar Planning Contest Held for Lincoln Employees

The management of the Lincoln Electric Co. has announced a postwar planning competition for employees. The purpose is to solicit suggestions on: (1) postwar products which the company is in position to build and which are along the lines of its present endeavor and (2) methods of manufacturing either such postwar products suggested or manufacturing the present products. Prizes of $500, $300 and $100 are offered for the best ideas.

» «

2,000 Planes for Navy Produced in One Month

More than 2,000 airplanes—both fighters and bombers—were produced for the Navy during the month of November, according to Secretary of Navy Frank Knox. Secretary Knox also revealed that in the same month—the best since the beginning of the production program—more than 250,000 standard displacement tons of naval craft of all types were produced, of which "by far the largest percentage" were combatant vessels.

"The production of fighters was especially pleasing," commented Secretary Knox.

1. Lay Down Electrode
2. Pick Up Hammer and Chisel
SAVE 7 STEPS Cleaning Welds
3. Lay Down Hammer and Chisel
Use
CMD
CHIPPING HAMMERS
4. Pick Up Drift
When you equip welders with CMD Triple-Duty Hammers, you eliminate seven time-consuming steps required to change from one tool to another. The triple-duty hammer—type CB—combines drift, chisel and wire brush in one tool. The user does not even have to set the electrode down to chip away slag or spatter. Speed up production and conserve man power with CMD Welder's Chipping Hammers. Order from your jobber. Descriptive circular sent on request.
5. Lay Down Drift
6. Pick Up Brush
7. Lay Down Brush
Triple Duty
TYPE CB
3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

(Trade Mark Registered)

Specify Titan Welding Alloys

TO ASSURE UNIFORMLY SOUND, STRONG, DUCTILE BRONZE WELDS

Doubly-Deoxidized PENN BRONZE, TITAN BRONZE and TITAN MANGANESE BRONZE Welding Rods have proved their definitely superior welding qualities over a period of many years and under the most exacting requirements.

The Double-Deoxidization process, developed by Titan engineers, definitely increases the ductility of the weld metal, reduces fuming to a minimum and assures a sound, dense, strong weld.

Doubly-Deoxidized Welding Alloys:

PENN BRONZE

TITAN BRONZE

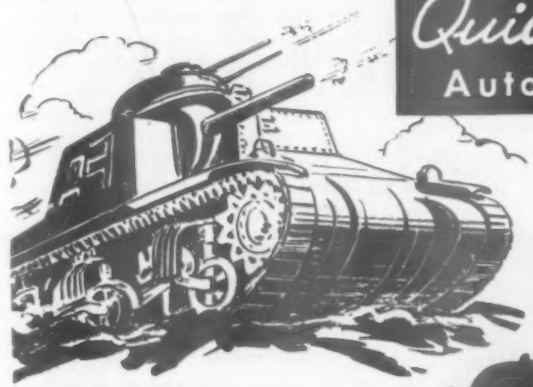
TITAN MANGANESE BRONZE

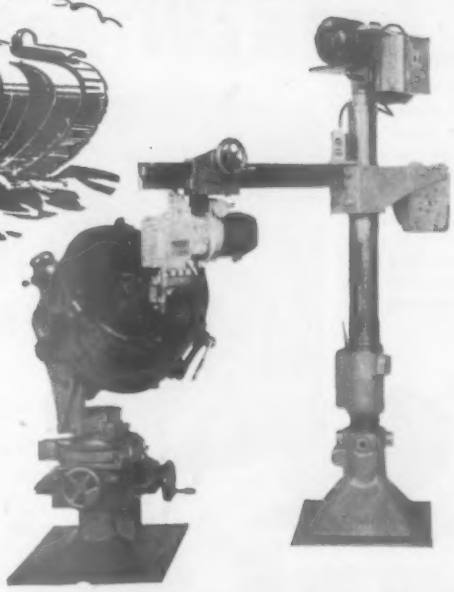
Descriptive literature sent upon request

TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN WELDING RODS

Quicker Welding . . With This Automatic Welding Machine Fixture





THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

Reloading Is done During Welding Operation

ACME *Manufacturing Co.*

1642 HOWARD ST. • DETROIT, MICH.

WRITE

for information. Whatever your positioning problem on automatic welding, let us help you solve it. Write for complete information.

Story of How Steel Got into Fight Told in Film

A picture packed with 35 minutes of excitement and thrills for all who care about victory is the United States Steel Corporation's new sound film, *To Each Other.* This shows old, practically forgotten mills being reclaimed and put to work again, a high-speed strip mill being transformed into a rolling mill for steel plates, the big new Utah steel mill going up, armor plate being made to sheathe ships, miles of steel tubing being rolled for aircraft, a steel tube being spun into a bomb ten times faster than a bomb was ever made before . . . and many other unforgettable scenes to blend into the composite impression of just what war actually means to the steel industry.

The title, *To Each Other,* was inspired by the closing pledge of the Declaration of Independence: ". . . we mutually pledge to each other, our lives, our fortunes, and our sacred honor." The workers shown are playing their real-life roles against a background of actual furnaces, mills, shipyards and construction projects.

The film is available without charge for showings to civic, professional, religious or fraternal organizations, employee groups, clubs, schools, etc. It can be furnished in either 35 mm or 16 mm size.

FOR WANT OF A NAIL THE BATTLE WAS LOST
FOR WANT OF A WELDER
PRODUCTION is Lost
. . . but today, breakdowns need not mean defeat in maintaining vital production schedules. Thanks to electric welding, strong, permanent repairs can be made "on the spot". No dismantling, no cost or waiting for hard-to-get replacement parts.
War production has proven that no other method can equal electric welding for fast, low cost metal fabrication . . . and it is in breaking bottle necks on the production line that the outstanding features of MARQUETTE Welders are best demonstrated. Here MARQUETTE performance is "tops" in speed, economy and welding quality.
BUY THE BEST . . . BUY MARQUETTE
LOW INITIAL COST • LOW COST OPERATION
NEGLIGIBLE UPKEEP • FAST, FLAWLESS WELDS • NO "MAGNETIC BLOW" • COMPLETE EQUIPMENT
Send for free, 24 page, illustrated booklet.
MARQUETTE MFG. CO., INC.
Minneapolis 14, Minnesota
MARQUETTE
a.c. arc welders

ABOUT PEOPLE

William B. Browning, formerly process service representative in Chicago for The Linde Air Products Company, has been recently appointed manager of process service for the company's southern division with headquarters at Birmingham, Ala.

» «

Harry S. Rose, formerly chief engineer of the Progressive Welder Co., Detroit, has been placed in charge of service and sales engineering activities with the title of chief sales engineer. He is succeeded as chief engineer by **Fred C. Handren,** formerly associated with the American Forge and Socket Co. and the A. C. Spark Plug Co. of Flint, Mich.

» «

William A. Blume has been elected a vice-president of American Brake Shoe Co. He has been president since 1940 of the company's Brakeblok Div.

» «

Dr. William G. Theisinger, formerly director of welding research of the Lukens Steel Co., Coatesville, Pa., has been appointed assistant to Vice-President D. S. Wolcott.

» «

Thomas T. Watson, who has been research metallurgist in charge of the research department of Lukens Steel Co. since 1939, has been appointed director of research for Lukens and its subsidiaries, By-Products Steel Corp. and Lukenweld, Inc. **D. Bruce Johnston** has been appointed assistant to the director of research and **Samuel D. Lemmon** takes Mr. Watson's former position as research metallurgist.

Mr. Johnston was formerly manager of development and research at Lukenweld, Inc. Mr. Lemmon came to Lukens in 1939 as an observer in the research department and in 1940 was appointed a metallurgical investigator.

» «

W. Earle Shumway has been appointed western sales manager for Norton Co., Worcester, Mass., succeeding **R. M. Johnson,** recently appointed general sales manager. **Raymond E. Taylor,** business research manager at Worcester, was appointed Chicago district manager to succeed Mr. Shumway.

» «

Frank H. Fisher, previously associated with American Steel Foundries, Chicago, has been appointed manager of the Welding and Cutting Division of The Bastian-Blessing Co., Chicago. He will supervise promotional and sales work of the company's "Rego" line and work in coöperation with users or prospective users of welding and cutting equipment to assist in their war production problems and postwar plans.

Ike Cue says

"Goggles are *BETTER* than Glass Eyes"

Ike Cue is right . . . and these Welsh metal frame, spectacle type goggles provide maximum safety* plus maximum comfort wherever eye hazards exist. They have rugged strength where strength is needed. The temples, covered with plastic tubing, are easy to adjust. Fitted with WELSHADE or WELSHARD lenses they are outstanding in every way for glare protection or chippers use.

LENSES

*WELSHARD clear, hardened lenses exceed Federal requirements by 100%, for impact resistance.

SIDE SHIELDS

in green or clear acetate . . . metal mesh . . . leather . . . or without shields.

WELSH
Metal Frame
Spectacle Type
GOGGLES

Write for Catalog

WELSH MANUFACTURING COMPANY
64 Troy St. Providence 9, R. I.

The Combination You've Often Wanted

•MOSLO•

LABORATORY WELDING ROD EXTRUSION PRESS AND WIRE FEED UNIT

Here is a 12-ton laboratory type hydraulic unit suitable for duplicating conditions of actual production (10,000 lbs. per square inch pressure) . . . Comes complete, with extrusion die-head . . . Ready to set on your floor, connect to your power line and start producing . . . Hydraulic and electrical controls at operator's fingertips . . . Welded steel construction . . . A smooth-working, efficient unit . . . Can be delivered in twelve weeks under proper priorities . . . Full information on request.

MOSLO MAKES EVERYTHING FOR THE WELDING ROD PROCESSING PLANT

MOSLO MACHINERY COMPANY

2443 PROSPECT AVENUE • CLEVELAND, OHIO

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Welding Trouble Chart

"Causes and Cures of 14 Common Welding Troubles" is the title of an 18 by 24 in. wall chart recently issued by **Westinghouse Electric & Mfg. Co.**, East Pittsburgh. This chart shows a photographic reproduction of each fault, opposite which is given the cause and the detailed cure. Thus a weldor should have little difficulty in diagnosing his welding troubles and finding their proper remedies. The 14 common troubles listed are: cracked welds, distortion, brittle joints, undercut, welding stresses, magnetic arc blow, irregular weld quality, corrosion, warping (thin plates), porous welds, spatter, poor fusion, poor surface appearance and incomplete penetration.

» «

Copper-Alloy Specifications

A helpful wall chart, 22 by 19 in., enables selection at a glance of the proper copper-base-alloy electrode in order to conform to any particular welding specification. Under the specification number appears the chemical composition of the alloy and its trade name; above are given the minimum tensile strength, yield strength, elongation and Brinell hardness requirements. The types of alloys covered include aluminum bronze, manganese bronze, beryllium copper, gun metal, red brass and silicon bronze. **Ampco Metal, Inc.**, Milwaukee 4.

» «

Murex Wall Chart

The new 34 by 20 in. wall chart that has just been issued by Metal & Thermit lists the important facts to help in the selection of the right Murex electrode for different types of work, advantages or physical characteristics. Described are electrodes for welding all types of steels, electrodes for hard-facing and electrodes for building up work parts. Six important suggestions for improving welding practice are also given. **Metal & Thermit Corp.**, 120 Broadway, New York City.

» «

Aircraft Spot Welding

"Spot Welding in the Aircraft Industry" is the title of a new 18-page, letterhead-size bulletin describing the Sciaky PMCR 2S-31 rocker arm welder for aluminum and light alloys. The booklet, Bulletin 105-B, discusses the impetus given by the war to the development of aluminum spot welding, explains the Sciaky principles of stored energy with preheating and variable pressure cycle, and pictures typical applications at various aircraft plants throughout the country. Reproductions are given of characteristic microstructures of typical spot welds in aluminum, magnesium and stainless steel. **Sciaky Brothers**, 4915 W. 67th St., Chicago 38.

» «

Silver Brazing Data

A letterhead-size instruction sheet for torch brazing with silver alloys has just been published by **Handy & Harman**, 82 Fulton St., New York City 7. It breaks down the brazing procedure into seven standard steps: fit of joint, cleaning, fluxing, assembling, heating, applying the alloy and flux removal.

SKILSAW
QUALITY
SANDING DISCS
LAST LONGER!
. . . sand better and faster!
Whatever your metal-finishing jobs may be . . . you'll finish faster and better with SKILSAW Quality Sanding Discs. They're scientifically made of finest materials to sand *smoother* and to wear *longer!*
SKILSAW Quality Sanding Discs are made of sharp-cutting aluminum oxide bonded with heat-resisting resin to a flexible fibre back. Available in 2 sizes and in all popular grits and grades to insure peak output on every job. Write for recommended types on your sanding operations . . . or phone your distributor for SKILSAW Quality Sanding Discs *today!*
SKILSAW, INC., 4763 Winnemac Ave., Chicago 30, Ill.
SALES AND SERVICE BRANCHES IN ALL PRINCIPAL CITIES
SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

CUTS CUTTING COSTS, TIME AND LABOR!

Gasweld **G-W PORTABLE**

FLAME CUTTING MACHINE

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EASY-FLO IS THE KEY to the success of this low-temperature silver alloy brazed construction, because it makes joints that are as strong as solid metal—and makes them fast, reliably and at surprisingly low cost per joint.

You will find interesting details about it in **Bulletin No. 12.** Also valuable information on joint designs, heating methods and fast production procedures. A copy will be mailed to you on request—write for it now.

EASY-FLO BRAZING IS HERE TO STAY. *The exceptional speed, reliability and economy EASY-FLO brings to the joining of both ferrous and non-ferrous metals account for the phenomenal spread in its use on war production and assure an increasing use in peacetime manufacturing. Get the facts in Bulletin No. 12-A. Plan to use it in your post-war production.*

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DISTRICT OFFICES
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Safety Gas Welding

"Gas Welding and Flame-Cutting" is No. 23 in the series of "Safe Practices Pamphlets" published by the **National Safety Council, Inc.**, 20 North Wacker Drive, Chicago. This 16-page, 8½ by 11 in. booklet discusses the hazards involved and the safe practices to be observed in carrying out gas-welding and cutting operations. Among the topics discussed are oxygen preparation and storage, acetylene preparation and storage, other fuel gases, acetylene generators, calcium carbide storage, compressed gas cylinders, cylinder storage, manifolding, regulators, hose and hose connections, torches, eye protection and clothing, health hazards and precautions, fire hazards and precautions. There is also included a suggested inspection report form for oxy-acetylene welding and cutting equipment, which lists 16 questions under "Cylinders," seven questions under "Regulators," seven under "Hose," three under "Torches" and 12 under "Operators."

» «

Manganese Steel Booklet

"Manganese Steel for the Railroad Industry" is the title of a 32-page, letterhead size booklet, Bulletin 943-R, just published by **American Manganese Steel Div.**, American Brake Shoe Co., Chicago Heights, Ill. Slanted wholly for the railroad industry, this publication includes a two-page discussion of the properties of manganese steel (standard austenitic manganese steel containing 10 to 14% Mn) and a page of questions and answers regarding this product. Though most of the remaining pages are devoted to a showing of parts made wholly from manganese steel, a few interesting examples are given of the use of nickel-manganese steel electrodes and other hard-facing rods for building up worn parts and applying wear-resistant coatings.

» «

Gas Regulator Bulletin

Comprehensive information concerning Victor "Gas-O-Dome" regulators is given in a newly published 8-page, letterhead-size bulletin. These regulators have gas-loaded instead of spring-loaded diaphragms and are made for inlet and delivery pressures said to be higher than can be handled adequately with spring-loaded diaphragm regulators. **Victor Equipment Co.**, 844 Folsom St., San Francisco 7.

» «

Magnesium Welding Data

A single-sheet letterhead-size bulletin prepared by **Eutectic Welding Alloys Co.**, 40 Worth St., New York City, describes a procedure developed by this company for the low-temperature welding of magnesium alloys and Dow metal. An alloy which binds at 960 F is used, this temperature being slightly below the melting point of magnesium castings. The bulletin describes the preparation of the joints, preheating procedures, welding on castings and on sheets, and finishing of the welded surface.

» «

Forms for Weld-Bend Tests

The weld-bend test is mandatory in ASME Boiler Code and API-ASME pressure vessel rules for welded joints which have to withstand severe stresses. Numerous other specifications also call for such tests. A pad of "Tempilscale" forms designed to facilitate and record weld-bend tests is being offered, gratis, by the **Tempil Corp.**, 132 West 22nd St., New York City 11. Besides spaces for recording the test data, each form has a ruled edge for measuring the distance between scribed lines to 0.01 in. and a table of the minimum distances required in order to pass the test.

» «

Pipe Plug Standards

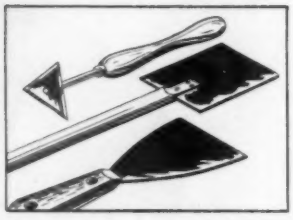
A new American Standard brings together in one document the various standards covering pipe plugs, pipe bushings, pipe caps and locknuts used in piping systems and other piping applications. The new combined standard is known as American Standard for Ferrous Plugs, Bushings, Locknuts and Caps with Pipe Threads (B16.14-1943). It is available at 40c per copy from the American Standards Association, 29 West 39th St., New York City 18.

Beryllium Copper Bites Into Steel

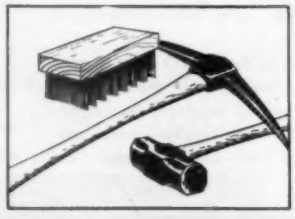
It is an old saying that when a dog bites a man it is not news, but when a man bites a dog it is news. That being the case, it is certainly news when copper bites into steel. Copper is, of course, one of the softer metals but when 2 percent beryllium is added to copper, its characteristics are changed. The alloy is heat treatable which explains the remarkable strength and hardness. Hit a chisel made of Beryllium Copper with a hammer and it will bite into steel without dulling the edge. Tools made of Beryllium Copper are non-sparking and therefore are used in ordnance plants, oil refineries and other places where explosions may occur from sparks off steel tools. Tensile strength as high as 200,000 lbs. psi can be obtained with Beryllium Copper; hence, it is used for many applications where resistance to high loading and impact fatigue are important, such as airplane motor bushings. Most of the critical springs and diaphragms used in aviation, Navy and Signal Corps instruments are made of Beryllium Copper because of its reliability as a spring material.

We hope this has proved interesting and useful to you just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for victory.

You can get complete information about these tools from the Beryllium Corporation, Reading, Pennsylvania.



Man has tried for ages to rediscover the art of hardening copper. Today this can be done by adding to copper a small percentage of beryllium.



Not only does it produce an alloy harder than tempered steel, but one that does not produce sparks, an essential when working near highly combustible materials.

Metro's New Coveralls

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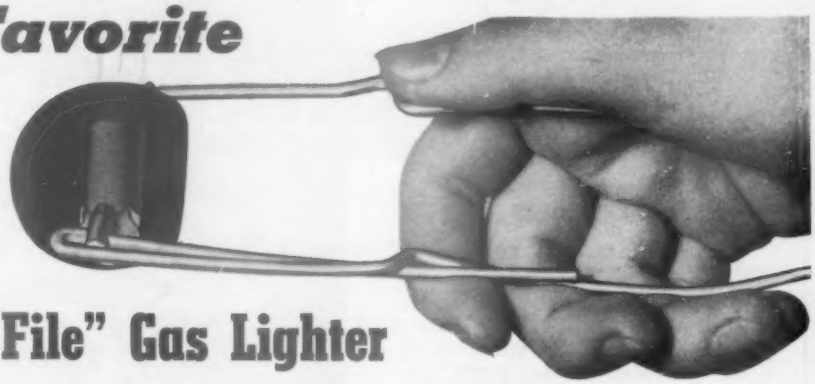

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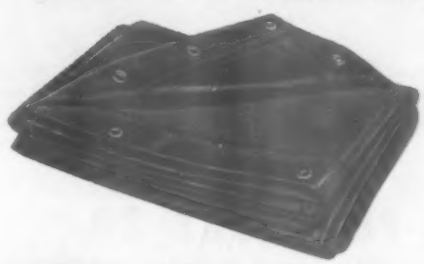

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Overseas Shipping Standards

Culminating an intensive three-year study of methods of preparing steel products for overseas shipment in wartime, a fully illustrated 180-page, 6 by 9 in. manual has just been issued. Titled "Packaging, Marking & Loading Methods for Steel Products for Overseas Shipment," this manual contains instructions which have been approved by the Army Service Forces, the Navy Department and the Procurement Division of the U. S. Treasury for wrapping, tying, boxing, marking and loading various steel products. In the preparation of these instructions, consultations were held with purchasing missions representing the British Empire, China, Russia, the Fighting French, Belgium, the Netherlands, Iceland and Turkey. Price $2.50. **American Iron and Steel Institute,** 350 Fifth Ave., New York City.

» «

Fire Codes

An authoritative guide for preventing fires incident to the handling of flammable gases is the new 504-page "National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives, 1943." This book supersedes the 1938 edition of "National Fire Codes for Flammable Liquids and Gases." Of special interest to the welding industry is the section on gases, which details those standards pertaining to "acetylene for lighting, heating and cooking" and "gas systems for welding and cutting." $3 per copy. **National Fire Protection Association,** 60 Batterymarch St., Boston 10.

» «

Training Manual for Women

A 24-page 6 by 9 in. manual, "Training Women for War Work," has been prepared by the War Manpower Commission for the guidance of training directors, women counselors and others responsible for seeing that women workers carry their load in war production plants. This pamphlet discusses ten aspects of the subject which have entered into successful training programs in plants employing women. These are: discovering the needs, adapting plant facilities, preparing the plant personnel, outlining the training program, preparatory training, induction training, on-the-job training, supplementary training, apprentice training and women counselors. **Apprentice-Training Service,** Bureau of Training, War Manpower Commission, Washington, D. C.

» «

Electrode Folder

A four-page 3½ by 6¼ in. folder has been issued to describe the new "Raco" Type H-D No. 11 A-C electrodes (AWS Class E-6011), which are designed to produce high quality all-position welds. **The Reid-Avery Co.,** Dundalk, Baltimore, Md.

Skilsaw Catalog

"How to Get the Most from Your Portable Electric Tools" is the title of a special section in the new catalog just published by **Skilsaw, Inc.,** 5033-43 Elston Ave., Chicago 30. Besides this maintenance data, the new catalog also carries descriptions and working illustrations of the portable electric tools being used in war production.

» «

Clad Steel Catalog

A newly published catalog on Jessop stainless-clad steel includes information on analyses, applications, manufacture, fabrication, styles of heads and standard sizes of sheets and plates. Special sections are devoted to the deep drawing, grinding, polishing, cleaning, gas-cutting, riveting, soldering and welding of this composite metal. **Jessop Steel Co.,** Washington, Pa.

» «

Research Brochure

An attractively printed 24 page, 14 by 11 in. brochure titled "The Inside Story" tells about the research and development work that is now being conducted by the **Square D Company,** Milwaukee, Detroit, Los Angeles. The company's research laboratory, to which an entire building is devoted, is completely equipped for chemical and metallurgical analysis as well as for electrical and electronics research.

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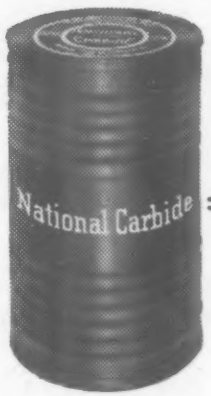

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Do You Agree?

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Resharpening Files

Q—Due to priority difficulties we are having trouble in purchasing files. There are, however, a number of used files around the shop, and I am wondering if there is any way that we can sharpen them.—*N. W.*

A—Files that are not too badly damaged may be sharpened by immersing them in an acid solution. Prior to attempting to resharpen a file, it should be thoroughly cleansed of oil and other particles of dirt, preferably by the use of a solvent. The files are then resharpened by immersing them for 20 to 25 minutes at room temperature in a solution composed of the following:

Sulphuric acid	7 oz.
Copper sulphate	2 oz.
Borax	2 oz.
Water	1 pt.

When the files are removed, they will be covered with a sludge. This should be removed by a vigorous wire brushing.

» «

Hot Shortness

Q—Frequently when working with some metals, I have noticed that they become extremely brittle. I am told that this is because they are "hot short." What is hot shortness?—*M. O.*

A—Hot shortness is a condition of metal which causes it to be very brittle at red heat, even though the metal can be bent without showing any signs of brittleness when cold or at white heat. This condition is largely due to a high sulphur and phosphorus content.

» «

Underwater Welding

Q—In a recent movie I saw pictures of underwater arc welding. Was this a Hollywood pipe dream, or is it actually possible to weld under water? If so, what kind of welding electrodes would be used?—*V. H.*

A—Underwater welding may be accomplished in much the same manner as ordinary arc welding is done. In this application, coated electrodes of the straight polarity type are used. So that the coating will not disintegrate under water, the electrode must be waterproofed prior to use. The waterproofing is a cellulose nitrate to which dissolved celluloid has been added. Underwater welding is generally limited to mild steels, but in emergency operations steel patches have been welded underwater over holes in alloy and high carbon steel plates. In underwater welding, it is also necessary to insulate the exposed parts of the electrode holder and to have a well insulated and waterproof welding cable. Having these items well insulated reduces current leakage and electrolysis.

Straight polarity must be used for underwater welding, particularly in salt water. If reverse polarity were to be used, there would be a rapid deterioration of any exposed metal parts of the electrode holder.

» «

Heat-Resistant Glass

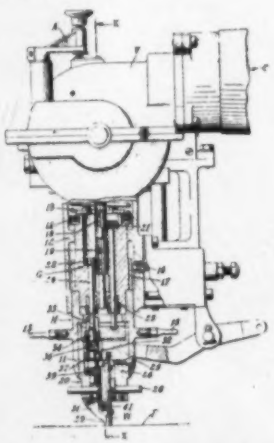
Q—We are interested in securing transparent heat-resistant shields, either 2 or 3 ft square, for use in connection with spot welders and heat-treating ovens. What type of material should we use?—*E. M. S.*

A—For transparent heat-resistant shields in the size you mention, it is suggested that you contact the Corning Glass Works, Corning, N. Y. This organization manufactures Pyrex glass. Pyrex is frequently used as peek hole covers for heat-treating furnaces and would undoubtedly serve the purpose you desire.

FROM THE PATENT OFFICE

Shape-Cutter Tracing Unit

2,334,824. **John D. Howell,** Ilion, N. Y., assigned to **Union Carbide and Carbon Corp.** Filed July 9, 1941. Issued Nov. 23, 1943.

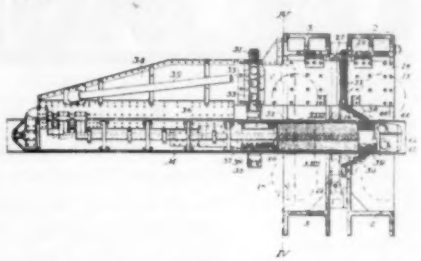


A driving unit for shape-cutting machines and the like, adapted to be manually guided in varying directions over a prescribed course. Unit comprises a housing manually pivotable about an axis, a traction wheel journaled to the lower part of housing, a positively driven sun pinion coaxially mounted within the upper part of housing, a planetary pinion in engagement with and revolvable about sun pinion as the housing pivots, and transmission means extending from the upper to lower part of the housing for connecting the planetary pinion and traction wheel.

» «

Tube Welding Apparatus

2,335,894. **James L. Adams, Jr.,** Youngstown, O., assigned to **The Youngstown Sheet & Tube Co.,** Youngstown. Filed May 20, 1930. Issued Dec. 7, 1943.



A method of welding the longitudinal seam in tubing by means of induction heating. After the tubing has been rolled to a uniform circular cross-section, a periodically varying current is induced peripherally around the material and once only across the narrow but still slightly spaced portion of the converging seam. Thus the seam edges are heated to the required welding temperature.

» «

Tube Welding Apparatus

2,335,895. **James L. Adams, Jr.,** Youngstown, O., assigned to **The Youngstown Sheet & Tube Co.,** Youngstown. Filed June 18, 1930. Issued Dec. 7, 1943.

This patent (see also No. 2,335,894) pertains to means for longitudinally feeding tubular material to be welded along the longitudinal seam, an induction heating coil, means for supporting the coil and means for producing relative movement between the coil and the tubular material. The peripheral portion of coil adjacent the proposed line of weld is spaced a greater distance from the tubing than the other portions.

» «

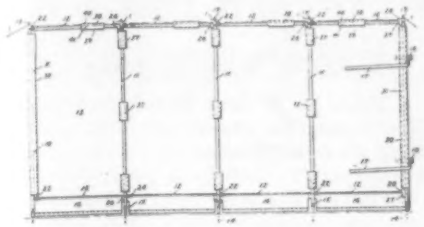
Pipe Brazing Method

2,336,297. **Robert M. Rooke,** West Long Branch, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed July 8, 1941. Issued Dec. 7, 1943.

A method of brazing galvanized pipes. End face of each pipe is shaped with both an outside bevel and an inside bevel of smaller radial extent. The pipes are positioned with their beveled ends confronting one another, and brazing material is melted into the circumferential seam. The brazing material is applied progressively around the circumference of the seam by means of a gas flame; its melting temperature is lower than the fusion point of the pipe metal and also lower than the boiling point of zinc.

Portable Welding Screen

2,335,274. **Harold D. Hampton,** United States Army, Aberdeen Proving Ground, Md. Filed Oct. 17, 1941. Issued Nov. 30, 1943.



A portable screen adapted to be collapsed into a roll. When assembled, screen is held in place by a series of spaced vertical staves to which are pivoted spaced folding links. Hooks on the free ends of the links engage sockets on all but one of the staves, thereby producing a sectionalized frame of rigid sections. A flexible wall over the frame is secured to each of the uprights.

» «

Seam Welder

2,336,403. **Clyde F. Kaunitz,** Bay City, Mich., assigned to **National Electric Welding Machines Co.,** Bay City. Filed May 1, 1942. Issued Dec. 7, 1943.

Pertaining to a seam welding apparatus, this patent covers a frame and a shaft on which a welding wheel is removably mounted. An outboard support is hingedly mounted on the frame for supporting the outer end of the shaft; a latch is provided for locking this support in its raised position.

» «

Spot Welder Electrode Holder

2,332,789. **Raymond L. Gann,** Chicago, assigned to **Rheem Mfg. Co.,** Richmond, Calif. Filed June 24, 1942. Issued Oct. 26, 1943.

In this spot welder electrode holder, two telescopic members are mounted for relative longitudinal displacement. One of the members is adapted for support and movement to and from the work to be welded, while the other member projects longitudinally from the first member. A resilient means urges the longitudinal extension of the second member from the first. The members are insulated from each other, and the electrode is carried by the second member.

» «

C-Clamp

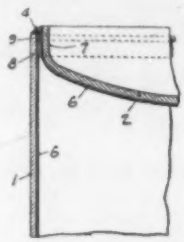
2,333,071. **Lyle L. Jannisse,** Detroit, and **John T. Spencer,** Birmingham, Mich., assigned to **Detroit Stamping Co.,** Detroit. Filed Nov. 8, 1940. Issued Oct. 26, 1943.

In this C-clamp there are a yoke and two clamping arms, one of which is rigidly associated with the yoke. The second clamping arm is pivotally attached to the yoke. An operating lever is pivotally attached at one end to the yoke and likewise pivotally attached to a link attached to the second clamping arm. The point at which lever and yoke are attached is forwardly of the point of attachment of the arm and yoke.

» «

Weld for Clad Tanks

2,332,454. **Wesley G. Martin,** Milwaukee, assigned to **A. O. Smith Corp.,** Milwaukee. Filed Nov. 1941. Issued Oct. 19, 1943.



Pertaining to a hot water storage tank, this patent covers the construction of a head with an interior lining to protect it from corrosion and a substantially cylindrical skirt; this head is joined by welding to a shell having a similar corrosion-resistant lining. A corrosion-resistant member is disposed between the meeting surfaces of the shell and head in order to prevent circulation of fluid to the weld, and a corrosion-resistant metallic ring is secured in the welded joint at the outer end of the corrosion-resistant member.

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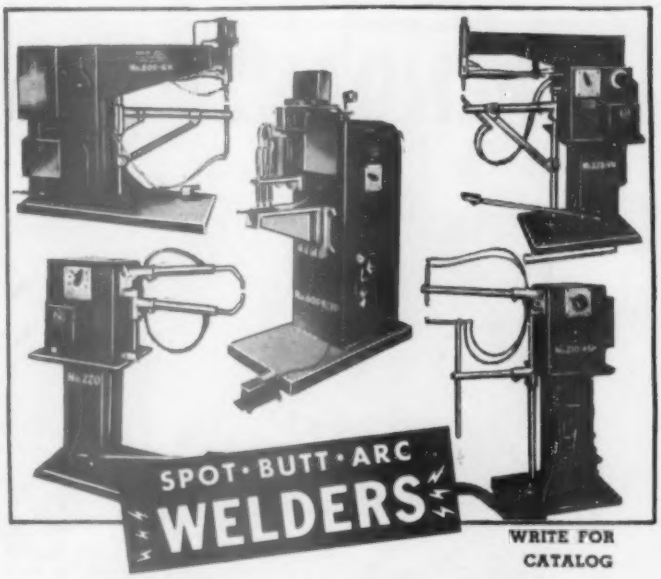

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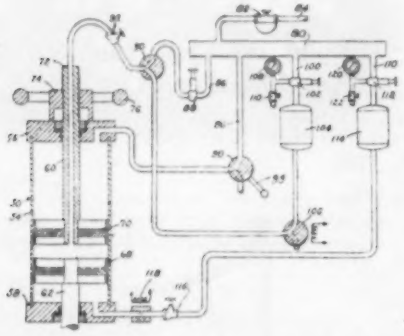
EISLER ENGINEERING CO.
749-SO. 13th ST. Near AVON AVE NEWARK, 3 N. J.

Spot Welding Method

2,331,537. **Malcolm S. Clark,** Warren O., assigned to **The Federal Machine and Welder Co.** Filed May 22, 1941. Issued Oct. 12, 1943.



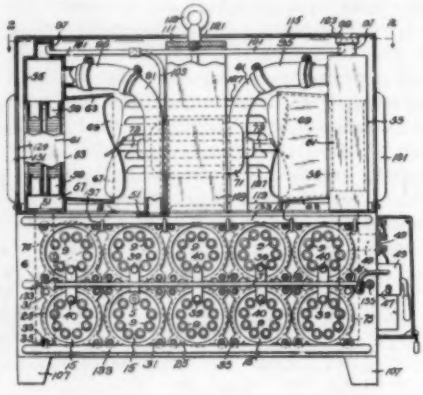
This patent covers a method and apparatus for resistance welding. A pair of welding electrodes are moved to engage the work and held in engagement with a weld-forging pressure. During the intial stages of the operation, the weld-forging pressure is counteracted with a lesser force which serves to reduce the pressure to a welding pressure only; after a given time interval, the lesser force is released in order that the full forging pressure may be applied to the electrodes to complete the weld by forging.

The apparatus includes a pair of relatively movable electrodes, means for exerting a force to move them together with weld-forging pressure, means for exerting a lesser force tending to hold the electrodes apart so that the resultant of the two forces will hold electrodes together with welding pressure only, and means for quickly releasing the lesser force so that the electrodes will be held together with the full forging pressure.

» «

Arc Welding Current Regulator

2,331,773. **Harold J. Graham,** Boston. Filed June 16, 1942. Issued Oct. 12, 1943.



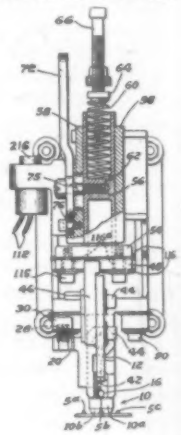
Current regulating apparatus for a multiple arc welding circuit. A number of exposed resistance elements are received by a liquid container and immersed in the liquid therein; the welding rod leads are connected in parallel to a common current source through the separate resistance elements. The liquid in the container is circulated through a heat radiator; the rapidity of such circulation and heat dissipated by the radiator will vary directly with the heating effect of the resistance elements on the liquid.

» «

Cross Wire Welding

2,332,022. **William Sayles Southwick,** East Lynn, Mass., assigned to **Thomson-Gibb Electric Welding Co.,** Lynn, Mass. Filed June 26, 1942. Issued Oct. 19, 1943.

A device for welding a strand and a stay wire of a preformed metal fabric at their crossing. An electrode formed of separable parts is adapted to be moved apart to receive one wire of the pair, thus extending the electrode through the fabric. The wire is received in a recess between the parts, permitting closure of the separable electrode parts. A shoulder on the electrode supports the other wire at the crossing, and a complementary electrode is adapted to be moved into contact with the first wire of the pair at the crossing in order to form a closed, electrically conducting path from one electrode to the other through both wires at their crossing.



» «

Arc Welding Process

2,332,950. **Hugo Tannheim,** Munich, Germany; vested in the **Alien Property Custodian.** Filed Aug. 22, 1940. Issued Oct. 26, 1943.

A process of arc welding in which the work and welding rod are connected to opposite terminals of a power source whose energy output decreases above a certain voltage. The electrode is fed toward the work at a constant speed such that the distance between electrode and work will continually increase because of the consumption of the rod. The feeding speed of the electrode is then increased to a substantially constant value sufficient to establish a welding voltage at least slightly in excess of the voltage at which energy output decreases.

» «

Soldering Iron

2,333,207. **John Ernest Smith,** Plainfield, N. J. Filed April 29, 1938. Issued Nov. 2, 1943.

An electrical soldering iron having a body heated by an electric element and a soldering tip. The tip has a solid working portion and an adjacent chamber in which is mounted an adjustable, thermally responsive switch. This switch is connected with the electrical heater circuit and operates in accordance with variations in the working tip temperature so that an even temperature is maintained.

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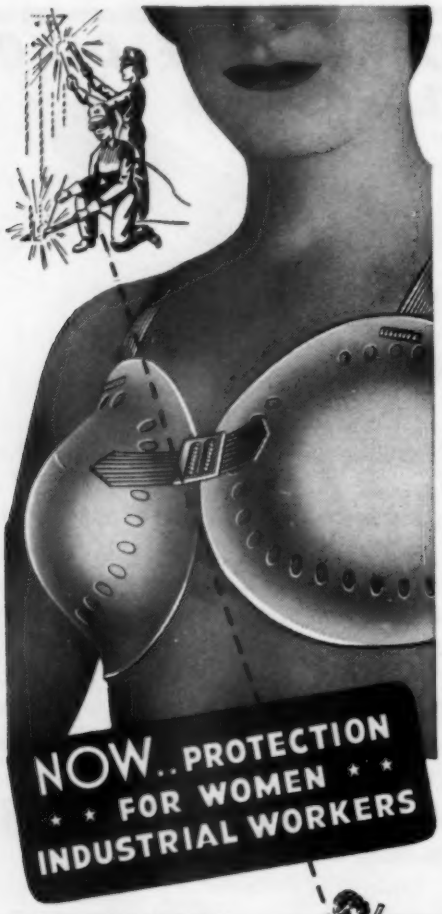

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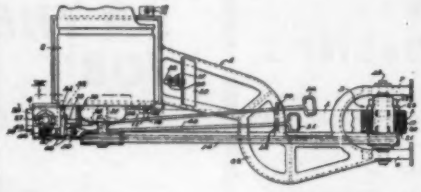
Abrasive Belt Grinder

2,333,507. **James G. Bair,** Pittsburgh, and **Joseph T. Shull,** Zelienople, Pa. Filed May 13, 1943. Issued Nov. 2, 1943.



A belt grinder with a horizontally disposed frame on top of which a motor is mounted. A presser roll is rotatably mounted on the front end of the frame, and an idler roll is rotatably mounted on the bottom of the rear end of the frame. A horizontally disposed grinding belt extends around both of these rolls, and a downwardly inclined driving belt extends from the motor to one end of the presser roll. A portion of the frame between the motor and presser roll is offset laterally to extend between the upper and lower strands of the driving belt, and the front of the frame is provided with yoke arms for engaging the ends of the presser roll. One of these arms extends between the upper and lower strands of the grinding belt.

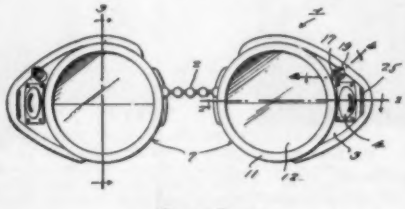
» «

Hardness Tester

2,333,747. **David F. Sklar,** Brooklyn, assigned to **Wilson Mechanical Instrument Co., Inc.,** New York City. Filed July 18, 1941. Issued Nov. 9, 1943.

A hardness tester comprising a housing frame having a seat, a bearing mounted below the seat, a screw in the bearing adapted to receive the test piece on its upper end, a nut receiving the screw and resting on the bearing, a loading indentor member in the seat, means for at times rotating the nut, a set of braking magnets mounted on the housing coaxially of the screw, a set of armatures mounted on the nut coaxial with the screw and adapted to be attracted and locked by the magnet set, and a controlled circuit (including the magnets) for energizing the set to lock the nut.

» «



Goggles

2,333,198. **Leo H. Riddell,** St. Vincent de Paul, Quebec, Canada, assigned 20% to **Gordon J. Turner,** Montreal. Filed May 6, 1943. Issued Nov. 2, 1943.

A pair of goggles comprising eye cups having sight openings in their forward ends, shields above the openings and lens holders mounted for rotary adjustment on the eye cups. The lenses are brought selectively before the sight openings and releasably secured in the adjusted position.

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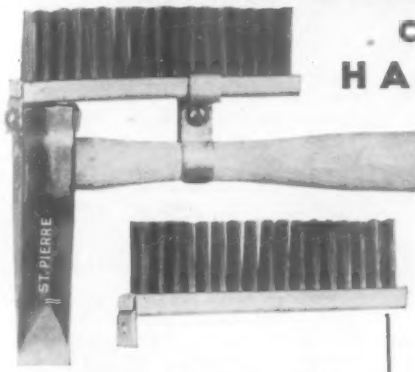

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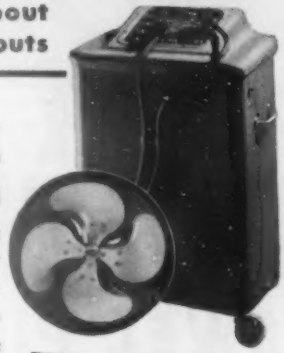

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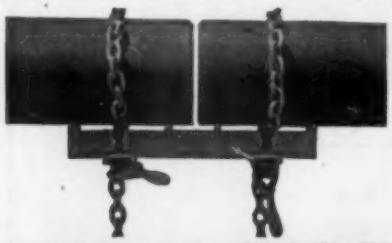

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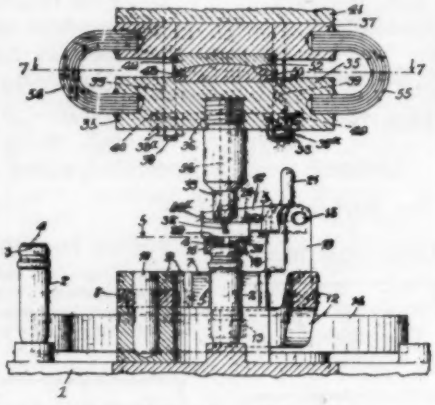
Pipe Protractor

2,334,422. **Carl H. Lehnus,** Lyons, Kans. Filed Feb. 4, 1943. Issued Nov. 16, 1943.

A protractor with a support adapted to extend longitudinally of and lie upon a pipe, support being anchored in position by flexible means. A protractor plate is pivotally secured to the support, and an adjustable encircling element is suspended upon the plate and adapted to fit snugly against the contour of the circular article to be marked. The encircling element comprises a pair of pivoted jaws, each with a plurality of adjustable links.

» «



Spot Welding Device

2,330,658. **John C. Albright,** Chicago, assigned to **The Dole Valve Co.,** Chicago. Filed June 8, 1942. Issued Sept. 28, 1943.

A spot welding apparatus that may be used for welding seal plates to shells. A holding device is included for holding the separate pieces while they are brought beneath the electrode. A power-applying member moves the electrode into contact with one of the separate pieces. The latter comprise two opposed parts with a space between them; these parts, though fastened together, are relatively movable. Two adjustable members of rigid material are located in the space between the parts; one of these is fixed to one part and the other to the other part. These adjustable members have contacting spherical-shaped faces, one convex and the other concave.

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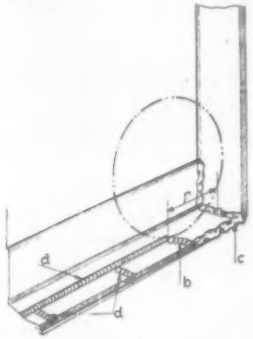
Welded Tank Construction

2,335,451. **Raymond Saulnier,** Paris, France; vested in the **Alien Property Custodian.** Filed Feb. 13, 1942. Issued Nov. 30, 1943.



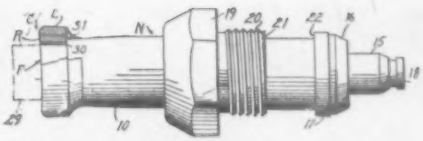
This patent pertains to a hollow structure having an angle iron welded to the lower edge of a vertical side so as to form a flange for carrying the bottom member. Bottom is welded to this flange by means of (1) a weld bead running parallel to the edges of the bottom member and (2) a plurality of transverse beads extending between the previously mentioned parallel bead and the edges of the bottom and the flange respectively, at right angles to these edges.

» «

Torch Tip Manufacture

2,334,257. **Edward J. W. Egger,** Bellevue, Pa., **Casimir V. Johanson,** Cranford, N. J., and **Ray B. Smith,** Pittsburgh, assigned to **The Linde Air Products Co.** Filed Jan. 14, 1939. Issued Nov. 16, 1943.

A method of making torch tips of the type comprising a metal body having a



front face provided with a gas outlet, a peripheral shoulder behind the face and a composite metal collar extending circumferentially behind the front face and bearing against the shoulder. The method covered by the patent consists of casting an outer protective member of wear-resistant metal on an inner metal member in order to make the collar. The body and collar are formed so that the body initially projects forwardly beyond the collar, but the projecting portion is removed after the collar has been permanently united to the body.

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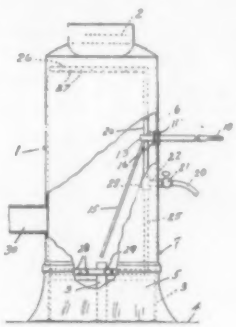

Arc Protector

2,336,283. **Clyde B. Neill,** Pearl Harbor, Territory of Hawaii. Filed Aug. 21, 1942. Issued Dec. 7, 1943.

A welding-arc protector comprising a hollow body open at its lower side and provided at its upper side with a viewing opening fitted with a welding lens; an electrode holder extending through a side wall of the body for supporting an electrode extending downwardly to the lower open end of the body; frictionally gripping means releasably engaging the side wall for adjustably supporting the holder for vertical movement relative to the hollow body; means for forcibly ejecting welding fumes.

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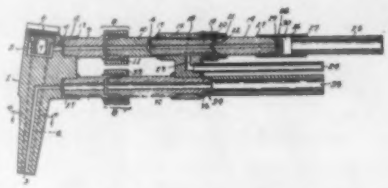

Cutting and Welding Torch

2,335,500. **Sanford J. Errett,** Portland, Ore. Filed August 17, 1940. Issued Nov. 30, 1943.

A cutting torch with a unitary head and cutting tip machined from a solid block of metal. Through the head and tip extend passages for high-pressure oxygen and other passages for low-pressure gases. These several passages are defined by homogeneous walls of metal.

» «

Hold-Down Dog

2,334,911. **John L. Drake,** Muskegon, Mich., assigned to **Ray W. Asbury,** Grand Haven. Mich. Filed Feb. 19, 1942. Issued Nov. 23, 1943.

A hold-down dog comprising a plurality of posts for the reception of a piece of work. Jaws slidably mounted on the posts may be forced against the work with the help of adjustable stop nuts threadedly mounted on the posts.

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MISCELLANEOUS

DISTRIBUTORS WANTED

Distributors wanted by manufacturer to handle welding electrodes, oxy-acetylene rods and accessories. Aircraft and shipyard accounts particularly desired. Box No. January No. 1.

Manufacturers! We have excellent coverage and volume of sales in eight states, through automotive and industrial jobbers, on complete lines of welding equipment and supplies.

We need—Connections with our trade name on such items as: A C welders, acetylene generators, gas equipment, welding rods, and practically all types of supplies.

Submit your proposals to be effective now—or not later than '44—so that post war business can be established.

We can supply you with A-1 credit references if your line is acceptable. Box No. January No. 2.

WANTED—WELDING CONTRACTOR

To furnish crew of about 50 weldors, with or without machines, for work on Navy Craft in Ohio River Shipyard; crew to include reliable foremen and leadmen; Prime contractor to pay wages at its prevailing shipyard rate, maintain all necessary records, secure Workmen's Compensation and public liability insurance, and furnish all primary articles of work such as rods, electrode-holders, etc. Please make immediate inquiry. Box No. January No. 5.

WANTED

Two atomic-hydrogen arc welders—any size. Ph. GRA 2455. 2415 W. Belmont Ave., Chgo., Ill.

ALADDIN ROD

No Puddling No Flux

Weld White Metal (die cast) Braze Aluminum easily and quickly when you use ALADDIN ROD and Patented Method. The only rod guaranteed to produce welds of greater tensile strength than the original metal. Instructions with every pound. Write us for Free Literature. Rod sizes: 1/16", 1/8", 3/16", 1/4", and complete assortment.

ALADDIN ROD & FLUX MFG. CO.

Dept. A, P. O. Box 935, Madison Square Station, Grand Rapids, Mich.

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Best Paid Welding Jobs go to men who are best trained. Get thorough training at this non-profit arc welding school. Expert instructors, individual attention and latest type practice machines. Write today for full details and low cost. Hobart Welding School. Box U-142, Troy, Ohio.

FOR SALE

For Sale—Welding shop equipment consisting of 1 portable 300 amp. welder, one 300 amp stationary welder with shaft extension, 5 gas torches, tips and gauges, 1 cutting torch, 3 combination torches, spot welder, fixed and portable grinders, drill press, electric drills, complete array of small tools, 2 trucks, one 50# acetylene generator, 600 Ft. flexible welding cable. All equipment in excellent condition. This completely tooled shop is located in a city of 4500 with an average gross for the past ten years of from $11,000 to $12,000 per year. Building may have long term lease. Wonderful opportunity for right man. Owner must sell. Price $9,000. Box No. January No. 3.

FOR SALE

1-200 KVA—220 Volt—60 Cycle—909 Amp, Type SM Taylor-Winfield Seam Welder; Machine Number 37289.

The machine has one 2 H.P.—220 Volt—60 Cycle motor with variable drive for driving tube welding fixtures. There is a 2¾" fixture which goes with the machine, also one set of Welding Wheels on the machine.

The machine is also equipped with a Westinghouse 200 KVA—220 Volt—60 Cycle Ignitron Welding Timer. This timer is equipped with Westinghouse Weldtroll sealed-off vacuum tubes. The serial number of this timer is 90N-820. Box No. January No. 7.

FOR SALE

Arc Welders—Big inventory reduction. Many makes and sizes, both a-c and d-c types. Very low prices without priority. A few samples: 75 amp Wilson $65.00; 100 amp Lincoln $95.00; 150 amp Lincoln $115.00; 200 amp Lincoln $135.00; 300 amp Una $165.00. Welding Engineering Co., 264 E. Ogden Ave., Milwaukee, Wisc.

YOU'LL BE WISE

To Remember and Investigate Independent Acetylene and Oxygen Cylinders, as to quality and price—available on suitable priorities—let us know your requirements and rating and we will be glad to obtain best possible schedule for you.

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